december 1959

nlgi spokesman

journal of the national lubricating grease institute

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Volume XXIII December, 1959 Number 9

Published Monthly by the National Lubricating Grease Institute, T. W. H. MILLER, Editor; SUSANN SNYDER, Assistant Editor, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. Telephone: VAlentine 1-6771. 1 Year Subscription, $5.00. 1 Year Subscription (Foreign), $6.00.

IN THIS ISSUE

THE COVER

SHOWN at the speaker's table during the successful Annual Meeting he had arranged as vice president and program chairman, H. A. Mayor, Jr., is pictured at the Roosevelt Hotel in New Orleans, shortly after his election as the 27th president of the National Lubricating Grease Institute. The election in October marks the change of administrations for the next twelve months and already, the new chief executive has pledged several new programs for the membership, as well as the retention of the old services. For the story on the Institute's president-elect, turn to 349.

NLGI PRESIDENT'S PAGE

By H. A. MAYOR, JR., *President*

Twelve Years of Service

One of the most prolific, sustained energetic terms of service in the history of the NLGI came to an end with the resignation of our Technical Committee Chairman, Ted Roehner, at the conclusion of our most recent Annual Meeting. As a further tribute to Ted in honor of this service, the following letter is brought to the attention of all NLGI SPOKESMAN readers.

Mr. Dayton Clewell
Socony Mobil Oil Company
150 East 42nd Street
New York 17, New York

Dear Mr. Clewell:

A unanimous resolution by the 1959-60 Board of Directors of NLGI directs me to commend Mr. T. G. Roehner of your staff to you, for the twelve years he served as Chairman of the Institute's Technical Committee. Ted has already received the Institute's highest honor, the Award for Achievement, and proper acknowledgements of his service were made during ceremonies at the recent Annual Meeting. It was further felt, however, that the governing body should acknowledge this service direct to his company and employers.

As you probably realize, the Technical Committee is the heart of the NLGI. As this Technical Committee progresses, so progresses our industry. Our industry has made big strides forward during the last twelve years due in a large part, we are sure, to Ted's committee leadership.

May we also acknowledge, at this time, the generosity of the Socony Mobil Oil Company reflected by their contribution of this expert's time and experience. Once again, the strength of the NLGI is built upon such service.

On behalf of the officers, directors and members of the NLGI, our thanks again to Ted and Socony Mobil.

Yours very truly,
H. A. MAYOR, JR.
President

If you concur with this thinking of the Board, would you too write a letter of thanks and appreciation to Ted?

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News About NLGI

Kolker Joins NLGI

Kolker Chemical corporation of Newark, New Jersey, has joined the Institute in an Associate member capacity. Lee H. Smith, assistant sales manager will act as NLGI Company Representative. E. G. Budnick will be Technical Representative. A feature article on this firm will appear in a later issue of the NLGI SPOKESMAN.

New Study Group on Marketing Formed

President H. A. Mayor, Jr., in response to requests from the membership, has appointed a market study group. This organization will report to the board of directors in February on ways and means to promote the use of lubricating greases.

February Board Meeting

There will be a meeting of the NLGI board of directors at the Park Plaza hotel, St. Louis, Missouri on Wednesday, February 24, 1960. The Institute's session will precede the API Lubrication Committee meeting, to be held on the following day.

NLGI Fellow Now K. C. Kim —to Report on Research Work in Future Issue

The new fellow now studying at the University of Utah graduate school is Mr. Kak-Chook Kim . . . he is working under Dean Henry Eyring, as have the previous students fulfilling the NLGI Research Fellowship. Mr. Kim replaces Mr. James Carroll, who was unable to finish his Ph.D. program.

Born in Seoul, Korea, Kim graduated from Berea college, Kentucky, in 1956 with a BA degree in chemistry. He received an MS in chemistry last summer at Utah and is continuing his graduate work toward a Ph.D. in physical chemistry.

A recent study made by Mr. Kim at the 1959 Annual Meeting on the construction of an autographic rotational viscometer, and its use for the study of thiotropy of grease will be elaborated on in a research paper for the NLGI SPOKESMAN at a later date.

Found—8 mm Camera

Found—at the NLGI Annual Meeting in New Orleans, during October . . . an 8-millimeter movie camera. This was turned in to the registration desk and never claimed. Owner may obtain it by writing a description to the national office.

NLGI Production Survey On 1959 Poundage

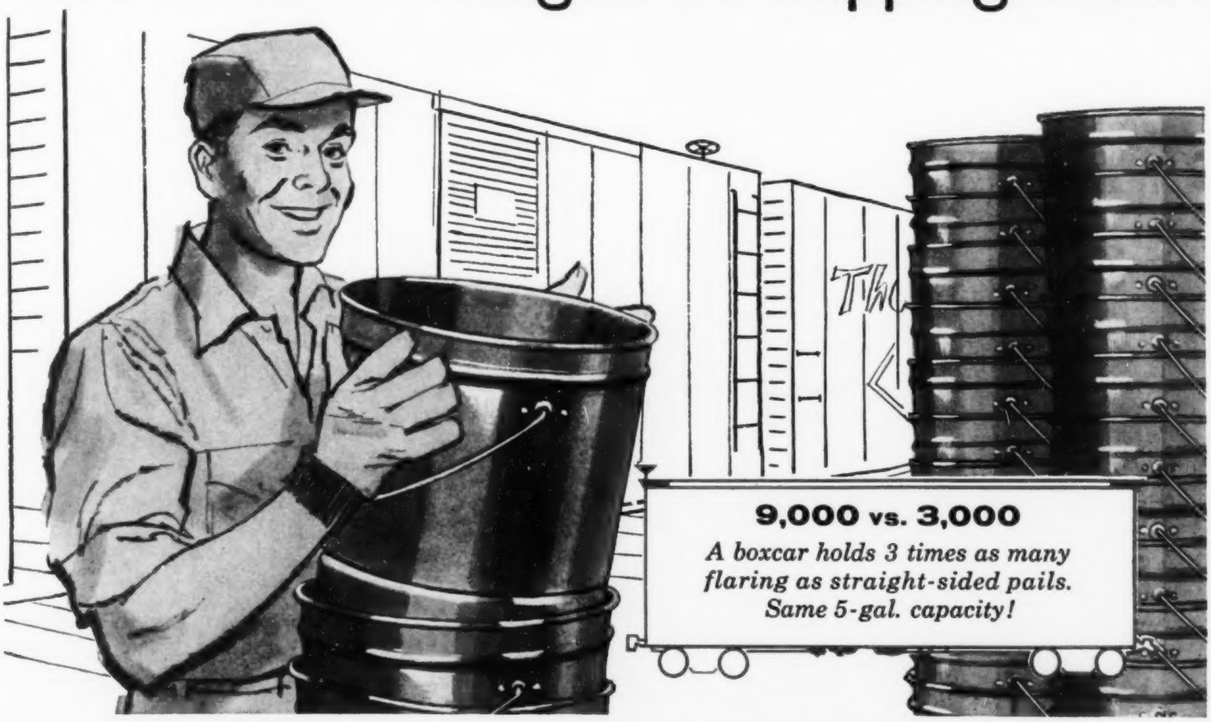
The third annual survey on production of lubricating greases and

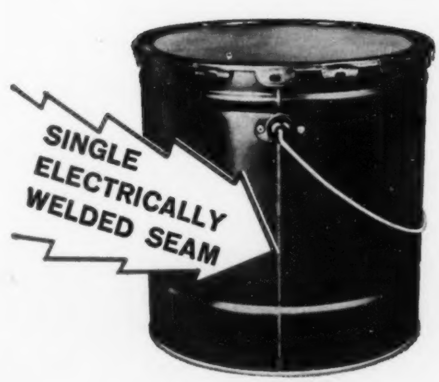
Continued on page 346

NEW FROM CONTINENTAL

Electrically welded, leakproof flaring pails

nest to save storage and shipping costs!





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790 Bay St., Toronto, Ont.
CUBAN OFFICE:
Apartado #1709, Havana

News About NLGI—Cont'd

Production Survey—

Continued from page 344

fluid gear lubricants was sponsored by NLGI, on total pounds in 1959. The management services division of Ernst & Ernst, national public accounting firm, will again conduct the gathering. Sample forms will be mailed in mid-December, while E&E will send actual questionnaires by registered mail in mid-January, 1960.

Although the response of almost 75 percent is considered excellent, the officers and board of directors of the Institute are urging every Active (manufacturing) member of NLGI to participate and thus give the final statistics greater impact. The usual anonymous procedures will be retained, insuring secrecy to all who fill in the forms.

OFFICIAL QUESTIONNAIRE

LUBRICATING GREASE PRODUCTION SURVEY FOR CALENDAR YEAR 1958

Please provide an analysis of your production in accordance with the definitions and instructions below using this form. These are the only copies of this form which will be provided. Keep one copy, and please mail the other to: Manager of Management Services Division, Ernst & Ernst, 600 Sharp Building, Kansas City, Missouri, using the enclosed self-addressed, stamped envelope. Replies may be sent by registered mail.

Type of Thickener*	Production during calendar year of 1958 in actual pounds
A. LUBRICATING GREASES	
1. Aluminum Soap	______ Pounds Produced
2. Calcium Soap	______ Pounds Produced
3. Lithium Soap	______ Pounds Produced
4. Sodium Soap	______ Pounds Produced
5. Other Soap	______ Pounds Produced
6. Non-Soap (Inorganic Thickener)	______ Pounds Produced
Grand Total of Lubricating Greases	______ Pounds Produced
B. TOTAL FLUID GEAR LUBRICANTS**	______ Pounds Produced

DEFINITIONS AND INSTRUCTIONS

1. Include all domestic production rather than sales data. In reporting your figures, be guided by the following ASTM definition for lubricating grease:
   "Lubricating grease - a solid to semi-fluid product of dispersion of a thickening agent in a liquid lubricant. Other ingredients imparting special properties may be included."
2. Include all production regardless of destination; i.e., whether domestic or export.
3. *Greases containing two or more thickeners should be listed under the category whose characteristics predominate.
4. Make no separate listing of EP greases.
5. Do not include process oils, cutting oils, textile oils, etc. in the above figures.
6. **In 'B' above, report total production in pounds even though your product is sold by the gallon. Do not include production of fluid gear lubricants in the grand total production of lubricating greases as defined.

A Reproduction of the Ernst & Ernst Questionnaire

Technical Committee Column

CHAIRMAN L. C. BRUNSTRUM

Standard Oil Company (Ind.)

Section Leader in Charge of Research on Greases and Industrial Lubricants

One of the newest and most important items for 1960 is the report of Mr. Gus Kaufman, chairman of the Dispensing Panel, who made the following recommendations in his annual report:

1. Upon acceptance of the finalized (automotive) dispensing method by NLGI, the Dispensing Panel will have completed its assigment and should be disbanded.
2. That the NLGI dispensing method be submitted to ASTM for possible further standardization.
3. That a new committee be organized to deal with dispensing problems associated with industrial centralized systems.

Action has been taken on the first two and the third is under consideration. Quite a bit of interest in this subject was evoked after Session B, at New Orleans. Anyone having knowledge or interest in central system dispensing is cordially invited to contact the Technical Committee chairman or the vice-chairman, M. J. Pohorilla and M. L. Carter.

New Technical Representative

Atlantic Refining company has named James W. Johnson, supervisor of industrial lubricants, application research, as NLGI Technical Representative.

Future Meetings

NOVEMBER, 1959

9-11 API, 39th Annual Meeting, Conrad Hilton, Palmer House and Congress Hotels, Chicago.

10-12 API, Marketing Division, Congress Hotel, Chicago.

DECEMBER, 1959

11-15 Society of Automotive Engineers, Meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

JANUARY, 1960

31-Feb. 5 ASTM, Committee D-2 Meeting, Statler Hotel, Detroit.

FEBRUARY, 1960

25 API Division of Marketing, Lubrication Committee Meeting, Sheraton-Park Plaza Hotel, St. Louis.

24 NLGI Board of Directors Meeting, Park Plaza Hotel, St. Louis.

MARCH, 1960

15-17 SAE National Automotive Meeting, Sheraton-Cadillac Hotel, Detroit.

23-24 Ohio Petroleum Marketers Assn., Annual Convention and Marketing Exposition. Deshler-Hilton Hotel, Columbus, Ohio.

APRIL, 1960

19-20 ASLE, Annual Meeting and Exhibit, Netherland—Hilton Hotel, Cincinnati.

20-22 API Division of Production, Rocky Mountain District Meeting, Gladstone, Henning, & Townsend Hotels, Casper

20-21 National Petroleum Association, Hotel Traymore, Atlantic City

MAY, 1960

18-20 API Division of Marketing, Midyear Meeting, Statler-Hilton Hotel, Cleveland

JUNE, 1960

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago

OCTOBER, 1960

30-Nov. 1 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago.

NLGI Elects H. A. Mayor, Jr. the 27th President

The 27th president of the National Lubricating Grease Institute—H. A. Mayor, Jr., is one of the youngest men to ever hold the office, but a veteran in the lubricating grease industry. Working up from the plant to his present position as executive vice president of Southwest Grease and Oil Company, Inc., in Wichita, Kansas. "Sonny" Mayor served in the various operating departments of the company until election to his present position in 1952.

His service with NLGI extends back for a considerable number of years, too . . . Sonny was elected to the board of directors in 1953 and since that time has been chairman of the membership, SPOKESMAN, publicity, awards, chassis lubrication and program groups . . . in addition to serving on several other committees. During the 1958-59 administration, he was vice president and head of the Annual Meeting for NLGI.

A graduate of Oklahoma Military academy, Sonny served three years in the mechanized cavalry during World War II, with two years of that overseas duty. From the Army he resumed his career at Southwest. Active in ASLE, ASA, SAE, and the API, he has also served as chairman of the petroleum packaging committee of the Packaging Institute. An avid sportsman, golf and hunting are just two of the hobbies he follows.

Mr. and Mrs. Mayor reside in Wichita, with their three children. Both of the Mayors are active in social and civic activities and are well known to the people of the Institute.

PRESIDENT'S ADDRESS—1959

Remarks by the 26th President of the National Lubricating Grease Institute at the Annual Meeting, New Orleans, La.

By F. E. ROSENSTIEHL
Immediate Past President, NLGI

It is indeed a pleasure to welcome you to the 27th annual meeting of the National Lubricating Grease Institute. Your Program Committee has worked long and conscientiously to secure papers of vital interest to all segments of our industry. I sincerely trust each of you will gain a great deal from your attendance, not only in matters pertaining to our great industry, but also through the business and social contacts you make.

In reviewing some of the talks given by our previous presidents, I note it has apparently been the practice to cover what has been accomplished by the Institute during their regimes. While I, likewise, will attempt to do this, I would also like to comment on how we, as members of the NLGI, can each contribute to its future growth and increase the benefits of membership. Since this year we are celebrating the 100th anniversary of the petroleum industry in the United States, I believe it is an opportune time to review targets for the future.

I believe we have provided and are providing our members with benefits equal or better than those of other trade organizations. However our accomplishments are no reason for complacency. There are always ways and means of improving our value to the industry. Following are some of our activities I would like to review:

Finances

Our capable treasurer tells us we are in a sound position financially, though the cash now on hand would not be considered large for a non-profit organization. If and when a sufficient surplus develops, I believe we should give some thought to additional expenditures for special projects, which would provide additional benefits to our industry. Additional research projects, activities for promoting additional use and sale of grease are some of the targets we might consider for the future.

Membership

As of September 1st our total membership was 152, broken down into 73 Active, 60 Associate, 12 Marketing and 7 Technical members. A year ago the total membership was 155. While our membership now comprises approximately 95 per cent of domestic grease manufacturers, I believe one of our future targets should be to make the coverage 100 per cent. This should not be a difficult job. Further, there are many suppliers to the grease industry, whether they provide raw materials, manufacturing equipment, or whatever, who would derive benefits from membership, as would the organization by their being members. Let's also make a special effort to secure additional members from this source.

NLGI-API Joint Container Committee

This is an extremely valuable committee, since we all know the high cost of grease packaging and its serious effect on profits. This committee now has tests un-

VETERAN of the oil industry for 42 years, F. E. Rosenstiehl has served NLGI since 1950, acting as a member or chairman of a number of committees. A former vice-president of the Institute, he was elected 26th president last year and completed his term of office at the Annual Meeting in New Orleans, this October. In the tradition of chief executives of the National Lubricating Grease Institute, he has recapitulated the past year, with forecasts for the future. Rosenstiehl is sales manager, product development and control, Texaco, Inc., in New York.

der way in an attempt to reduce costs by using lighter gauge steel. Fibre drums are also being considered. Tests are now under way involving five-gallon pails, 55-gallon drums and 120 and 400-pound removable head drums. Cheaper shipping cases are also under study. Recently there has come to the fore the use of large containers, some holding as much as 4,000 pounds, made of both steel and rubber. Undoubtedly, where adaptable, these large bulk containers will be extensively used, though this poses some problems of filling and distribution. Since high packaging costs are a major industry problem, let's all set as one of our targets means of lowering packaging and shipping costs.

NLGI Spokesman

I am sure we will all agree this is an outstanding publication, going to 95 per cent of the domestic grease industry and being sent into 33 foreign countries. The editor is continually on the lookout for good articles of interest to all phases of our industry. The magazine should provide a platform for members' ideas and interests, and create a better means of communication throughout our industry. Why not submit to the editor some of your thoughts? If the membership takes a more serious interest in contributing significant articles, this may be one means of building up the magazine so that it will attract more advertisers. You may or may not know that the SPOKESMAN is now published at a loss, and since we depend on the ads to help finance its publication, one of our targets should be to build up the SPOKESMAN by contributing articles and attracting more advertisers. Let's all do our utmost to make further improvements in an already outstanding "Spokesman" for the grease industry.

Production Survey

We have already received many inquiries for the results of the second annual survey covering lubricating greases and fluid gear lubricants produced in 1958 in the U. S. and Canada. This survey will be published shortly. Briefly it shows that in 1958 there were produced in the U. S. 536-million pounds of various type lubricating greases and 495-million pounds of fluid gear lubricants. Our Canadian friends produced approximately 33-million pounds of lubricating greases and 32-million pounds of fluid gear lubricants. This is a lot of grease and gives you some idea as to the size of our industry.

As a matter of interest, only 73.4 per cent of the total number of confidential questionnaires mailed were returned. While we anticipate that well over 90 per cent of the grease production is accounted for in this survey, the figures would be much more valuable if we came closer to 100 per cent coverage. As one of our future targets let's attempt to get a larger percentage return of the questionnaires. Incidentally, I am sure the committee handling the survey would welcome any member's comments as to the manner in which the survey is conducted. Why not send in your thoughts and suggestions in this regard?

TECHNICAL Committee work continues to grow. Here, J. J. Dickason moderates a new Technical sub-committee symposium on the aspects of manufacturing operations.

Technical Activities

Under the able leadership of Ted Roehner, the excellent work done by our Technical Committee is well known. Since Ted is retiring as chairman at the end of this session, may I, at this time, pay him a personal tribute. Probably few members realize the many hours of time and effort Ted has put into this activity during the past twelve years, and on behalf of the entire NLGI membership . . . many thanks Ted for a job well done.

You will hear more of the committee's accomplishments at the Technical sessions on Tuesday and Wednesday, and I do not wish to intrude on any of the committee's reports in this regard. You should, however, know that during the past year many of the subcommittees have been reorganized in order to obtain maximum efficiency and broaden their scope of activity. There are now nine subcommittees, a steering committee and a grease incompatibility study group. All the technical areas of current interest to NLGI are being covered by one of these committees.

New subcommittees formed during the past year include one on manufacturing operations. Its formation draws attention to the fact that NLGI recognizes the key importance of grease manufacturing, and it is hoped through its organization to facilitate exchange of technical information concerning manufacturing equipment and processes. A subcommittee on Gear Lubricants has also been organized to keep in step with NLGI's decision to include gear lubricants, particularly industrial, in its scope of activities.

The scope of the fundamental research committee has now been enlarged so that it now covers the assignment formerly taken care of by the NLGI research fellowship committee.

An appreciable number of the subcommittee mem-

HONORS to W. H. Saunders, Jr., who acknowledges NLGI "Award for Achievement" just given him at the annual banquet, for his 25 years as a member of the board.

bers are Associate members, which indicates that the activities of the Technical Committee encompasses the entire membership.

The activities of this committee are considered so important that this year, as was the case last year, technical sessions will be held concurrently with other sessions. It is worthy to note that the activities of the Technical Committee do not duplicate the activities of any other technical organization, such as ASTM Technical Committee G. During the past twelve months important progress has been made by a majority of the subcommittees and reporting of that progress should be one of the highlights of our meeting.

As to the future targets of the Technical Committee, these will be largely determined by your participation in the technical session on Wednesday. Activities which I believe should be further explored include: expansion of efforts in the development of recommended practices; fundamental research projects in addition to the research fellowship on flow properties of grease, now under the direction of Professor Eyring of the University of Utah; specific symposiums on other technical phases might also be considered.

The work of this committee is one of the major benefits of membership and it would seem to me in the future we should attempt to broaden its scope of activity and encourage participation by all members.

Manufacture

The steady development of improved grease formulations over the past several years has forced the industry to devise new and more efficient manufacturing methods, including more efficient equipment for mixing, homogenizing, deaerating, etc. Quality control methods have also improved. You will note that one of the sessions of this meeting spotlights manufacturing procedures and equipment. I believe in the future we should give more attention to this activity, covering not only grease manufacturing procedures, but also manufacturing equipment, since many of our Associate members are in the equipment manufacturing business. One of our future targets should be to disseminate information on grease manufacturing equipment and procedures, similar to what API now does for other petroleum products. This is an exclusive sphere of NLGI activity, which is not in competition with that of any other organization, and should promote the interests of many of our Associate members.

Promotional Material

During the past year a booklet covering *Recommended Practices for Lubricating Passenger Car Ball-Joint Front End Suspensions* was issued and over 25,000 copies have been sold in the two months it has been offered. The Wheel Bearing booklet previously issued continues to have excellent acceptance, over 150,000 copies having been distributed to date. Our movie, "Grease the Magic Film," likewise has had excellent acceptance, with approximately 100 prints having been sold to date. Surely there is other promotional material which the Institute should make available. The membership should make known their needs in this regard.

Marketing

During the past year a serious threat has confronted us in the proposed elimination of chassis lubrication points in passenger cars. While it appeared this would occur extensively in the 1960 models, fortunately this is not the case. However, there have been various industry rumors to the effect that 1961 will see an appreciable number of cars equipped with non-lubricated chassis bearings. Various suggestions have been made as to how we should combat this portending threat, ranging anywhere from working with such organizations as the National Safety Council, AAA, Automobile Lift Institute and, of course, directly with the car manufacturers. Our motives are not entirely selfish in this regard. There are many, many cases on record where a serious mechanical defect was discovered at the time the chassis was being lubricated.

The chassis lubrication committee is now reviewing means by which we can better promote periodic chassis lubrication. One of the most fruitful avenues of approach is to work with the car dealer and service station dealer on the many sales opportunities that arise during periodic chassis lubrication. It has been said that chassis lubrication is a habit service for the average car owner. However, a car on the lift is a sales room for the sale of other profitable items by the dealer. Promotional suggestions such as placards, invoice stickers, envelope stuffers, car window stickers, etc., stressing the need and value of periodic chassis lubrication would all help. Again, this is a sphere of activity where the entire membership can assist, stressing to all the motorists with whom they come in contact, the need to "Lubricate for Safety" and the other advantages of periodic lubrication.

As you know, a tentative NLGI dispensing method has been developed through the excellent working arrangement set up by grease marketers and grease dispensing equipment manufacturers. This is an important activity which should be continued, since we all know there is frequently a compromise between proper product to use versus pumping equipment available to dispense the grease.

Summary

In closing, I believe our overall targets should be:

(1) To give the best possible service and information to all who have an interest in grease, be it manufacturer, marketer, consumer, etc. In regard to the consumer, let us not forget it is he who keeps us in business, and it is our responsibility to provide him with a product to lubricate his equipment in the most efficient and satisfactory manner.

(2) The potential reduction in grease fittings on passenger cars is a definite challenge to our industry. Let's do our utmost to develop and market greases that will do a better lubrication job than would be possible with any non-lubricated bearing, and let's sell the car manufacturer on this.

(3) Let's sell the motorist on "Lubricate for Safety." And periodic chassis lubrication.

(4) We will have to depend more and more on ourselves to develop new grease consuming outlets. In the past these have come to us, in many cases, gratuitously. Present tendencies are to reduce grease consumption by elimination of leakage and waste. It is up to us to put grease into more channels of use than heretofore. There are many cases where grease could be employed and do a better job than materials used originally. One recently came to my attention . . . as an undercoating for passenger cars. Let's all look for ways and means to broaden the market for grease. It's a large market now . . . let's make it larger.

Acknowledgments

Now that my term of office is coming to a close, I would be remiss if I did not acknowledge the outstanding help, sound counsel and support given to me by all during my term of office. There has not been a job on which I have requested help, be it from the officers, directors, or the general membership, which has not been handled willingly and well. The various committees have all functioned with one thought, to complete their assignments in the best interests of the Institute and our industry. Our general manager and his staff, who operate so efficiently, have also been of untold help.

Again many thanks to all our members whose frequent suggestions and comments have been most helpful.

Appreciation is also acknowledged to our Associate members who graciously supported the "Early Bird" reception. And last but by no means least . . . the outstanding work of our program committee, under the chairmanship of Sonny Mayor, for preparing such an excellent program, from which I trust you will now all enjoy and derive lasting benefit. ■

LAST official duty for Rosenstiehl, who opened the annual meeting with the address accompanying these photographs, was to turn the president's gavel over to his successor. With his term completed and with Mrs. Mayor a proud witness, he offers congratulations to H. A. Mayor, Jr., at the traditional annual banquet of the NLGI annual meeting.

Road Evaluation of Automotive Chassis Greases

By:

E. W. Tracy, Jr.

Southwest Research Institute

E. E. Smith

Climax Molybdenum Co.

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

I Introduction

Continued improvement and increased performance demands placed on automotive equipment have created the need for new and improved types of chassis greases. The subsequent development of such products has in turn created the need for adequate methods of evaluating them. One such method used in a program involving over two million road miles will be described for you in this paper.

It has long been the technique of the petroleum industry to make every effort to devise laboratory tests that would adequate and accurately predict the performance of fuels and lubricants in consumer use. Many such laboratory evaluations have been quite successful and are able to predict accurately how well a particular product will perform. However, the application of such laboratory tests to chassis greases is limited, since field correlations are not yet available. It is quite clear that laboratory evaluations of chassis greases serve as an excellent screening tool but an accurate forecast of how such a product will perform in actual use can only be accurately determined through extensive road testing designed for this purpose.

The adequately designed road evaluation program must measure directly the performance of a grease, under realistic conditions, in a vehicle. Much, if not all, of the early work accomplished in field evaluation of chassis greases was based upon the reaction of experienced drivers. These facts were clearly presented in a 1955 S.A.E. paper by Mr. J. L. Kehoe, Jr., who was at that time a member of the Structure and Suspension Development Section of the General Motors Engineering staff. In contrast to these early tests based on driver reaction alone, the current trend is to develop testing techniques capable of producing quantitative data that will not necessarily eliminate the experienced driver's reaction tests but rather supplement them. It is hoped that a development of such quantitative data will ultimately lend itself to a usable correlation with laboratory data.

The principal objective of this investigation can be stated briefly as follows: to determine the relative merits of two chassis greases, one a commercial grade multipurpose automotive grease and the other the same grease with an anti-wear agent added, with regard to wear of chassis parts under the most arduous conditions found in normal automotive uses on today's highways and city streets.

It is interesting to note that the need for an adequate chassis grease stems from the introduction of the independently sprung front end suspension in the early 1930's. Some of the problems that plagued the industry

FIGURE 1, technician measuring heights of tie rod ends and Ford ball joint suspension members with the aid of a vernier height gage, reference blocks and surface plate.

FIGURE 3, technician weighing aluminum bushings for Fruehauf trailer G. T. suspension.

in regard to chassis greases in these early days are still prevalent today. One of the most outstandingly troublesome of these problems is that of short-lived lubrication.

The difficulties involved in the evaluation of chassis grease are manifold. It was found that performance studies of these products in terms of wear of lubricated parts were considerably more difficult than such studies based on driver reaction alone. The driver reaction criterion produced usable results, however, such procedure did not indicate differences between products quantitatively. For this program, therefore, many new techniques were developed so that the desired comparison could be made.

In most instances, the test parts could be weighed and/or measured using normal laboratory techniques. However, some of the parts, such as the steering tie rod ends and Ford ball joint suspension members, required special techniques. These parts are manufactured as sealed units and any attempt to disassemble them is destructive to the unit. Earlier production methods allowed parts such as these to be manufactured with provision for disassembly, but the modern sealed unit cannot be disassembled without destroying its possible future use. Accordingly, a method was devised that would allow a measurement of this part to be obtained as illustrated in this photograph (Figure 1). The back or seat of the unit was faced and a line scribed on the tapered stud. A jig was fabricated to hold the test part in an upright position to allow measurement between the surface plate and the scribed mark on the tapered stud by means of a height gauge. Wear during the test would cause the parts within the tie rod end to "erode," making the scribed line move further away from the surface plate. The distance the line moved would then be the measure of wear.

It was felt that by using methods such as the one described above for tie rod ends, where needed, and the more normal techniques some of which are shown in Figures 2, 3 and 4, data were collected that were more useful.

FIGURE 2, technician measuring internal diameters of truck and trailer parts—using a caliper micrometer and a telescope gage.

FIGURE 4, technician measuring external diameters of Fruehauf trailer G. T. suspension shafts—using caliper micrometer.

For the purposes of this study it was found economically unsound and technically unnecessary to purchase new equipment and run a fully controlled road test. The over-all costs of the entire program were drastically reduced by using commercial fleet equipment in regular service. Even though it was sometimes found necessary to subordinate test procedures and objectives to the normal vehicle usage, thereby causing occasional inconsistencies in mileage, service periods, etc., the quality of the data was not affected with regard to its subsequent use. These minor inconsistencies are an inherent part of the method used and cannot be eliminated; however, the rather obvious advantage of performance data under conditions of commercial use tends to offset, at least in part, these inconsequential differences.

II Facilities, Equipment and Supplies

A. *Selection of Test Equipment*

A careful survey was made to locate and select equipment considered usable for this investigation, including but not limited to that in the immediate San Antonio vicinity. A systematic search of large operating fleets indicated that it was possible to select vehicles that not only met the program requirements but were operated in such a manner that a minimum of test interruption would be encountered. Fleets with the specified type and required number of vehicles were considered regardless of their location even though proximity of the equipment would greatly facilitate preparation and afford a better opportunity for direct personal supervision of the periodic servicing of the test vehicles. In one instance, the requirement for vehicles of a specific type, about the same age, approximately in the same mechanical condition, and operating on similar schedules, necessitated the use of a fleet operating out of Winston-Salem, North Carolina. Otherwise, fleets that satisfied the program requirements were located in San Antonio.

FIGURE 5, typical Ford police vehicle.

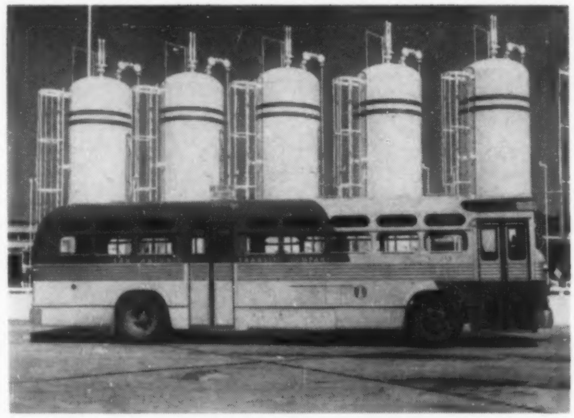


FIGURE 6, typical city bus.

Where several acceptable types of vehicles were available within one fleet operation with more than the requisite number of a particular type, the assistance of the maintenance supervisor in making selections was solicited and followed whenever possible. In all cases, the cooperation received from the fleet owners and their maintenance personnel was excellent.

The final selection of vehicles was a follows:

1. Ten (10) 1955 Ford sedan passenger automobiles from the San Antonio Police Department typical Ford shown in Figure 5.
2. Eight (8) FL-35 Twin Coach, Group 200 buses from the San Antonio Transit Company typical city bus shown in Figure 6.
3. Eight (8) RD-225H International Harvester Tractors equipped with Cummins Diesel Engines, owned by a commercial hauler in San Antonio.
4. Two (2) Model 521-C Kenworth Tractors equipped with Cummins Diesel Engines—owned by commercial haulers in San Antonio. Typical Kenworth tractor is shown in Figure 7.
5. Ten (10) Fruehauf GT-55 Semi-Trailers—eight from McLean Trucking Company of Winston-Salem, North Carolina, and two from commercial haulers in San Antonio—typical trailer shown attached to Kenworth tractor in Figure 7.

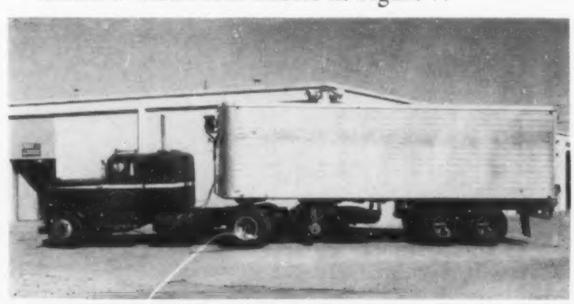


FIGURE 7, typical Kenworth truck tractor.

B. *Test Facilities*

The Fleet Laboratory facilities of Southwest Research Institute were utilized for preparation and service during test of the following vehicles: Ford sedans, Kenworth Tractors, International Harvester Tractors and two of the Fruehauf GT-55 Trailers.

Facilities of the San Antonio Transit Company were utilized for the preparation of the City Buses used on the program.

The maintenance facilities of Modern Automotive Services, a subsidiary of McLean Trucking Corporation of Winston-Salem, North Carolina, were used to prepare and service eight of the Fruehauf GT-55 Trailers.

C. *Preparation for Test*

Half of the vehicles of each type were assigned to operate with the test grease and half with the reference grease. The Kenworth tractors were an exception. Since there were only two, operated independently, the application of the two lubricants was divided equally between like lubrication points of each vehicle.

It was mandatory that every available precaution be taken to preclude the inadvertent use of grease not assigned to a particular vehicle. It is quite obvious that even one misapplication of either the reference grease or the test grease would cause differences that would be extremely difficult, if not impossible, to evaluate. For these reasons, distinctly different types of grease fittings for the application of the two greases were installed on the vehicles as they were prepared for test. The fittings chosen were not only different from each other but were also different from those normally used by the vehicle manufacturer. As an added precaution against possible contamination, and to serve as a check for the service personnel, the fittings themselves and as much of the under carriage as possible were painted to conform to the color code of the grease assigned to the unit. Black was used for the test grease and yellow for the reference grease.

Where applicable, a definite system of identifying each test part with the vehicle number, position on the vehicle and position on the particular part, was established to preclude any possibility of interchanging the identical parts of the various vehicles at any point in the program. The identifying numbers and letters were etched directly on the parts so that tags or other attachments were unnecessary.

Special emphasis was placed on the packing of front wheel bearings. In an effort to insure that each bearing received the same treatment, the *N.L.G.I. Recommended Practices for Lubricating Automotive Front Wheel Bearings* was followed in the strictest detail.

III Experimental Procedure

A. *Analysis of the Problem and Method of Solution*

The procedure for the subject road evaluation was developed at the request of a commercial sponsoring company, Climax Molybdenum, by Southwest Research Institute's Road Evaluation Laboratory. The Climax Molybdenum Company had determined through laboratory testing that additions of small quantities of a commercial product, molybdenum disulfide by name, to chassis greases resulted in less wear than the same product without the anti-wear additive. On the basis of these promising results, a road test especially designed to evaluate the anti-wear additive for chassis greases was conducted to determine whether similar behavior would be encountered under actual service conditions.

The vehicles selected for road tests were divided into four main groups on the basis of type of vehicle and character of vehicle service to achieve a comprehensive evaluation of the test product. The four groups are characterized by diversification of vehicle usage and inherent differences in design of the vehicles as indicated in the following tabulation:

Group 1 Ford passenger automobiles — Urban type traffic operation conducted over the city streets of San Antonio, Texas.

Group 2 City Buses—Heavy duty urban type traffic operation conducted over the city streets of San Antonio, Texas.

Group 3 Tractor-Trailor — Open highway operation, over these road courses:
- a. San Antonio to San Francisco
- b. San Antonio to New Orleans and San Francisco
- c. San Antonio to New York City, Cleveland and Chicago

Group 4 Trailer—Open highway operation, over these road courses:
- a. San Antonio to San Francisco
- b. San Antonio to New Orleans and San Francisco
- c. Atlanta, Boston and Chicago

Half of the vehicles of each group, with the exception of the two Kenworth tractors, were assigned to operate with the test grease, and half with the reference grease. The application of the two lubricants to the Kenworth tractors was divided equally between like lubrication points of each vehicle. In this manner, the effects of the two lubricants on the wear of various chassis components could be compared directly.

B. *Description of How the Test Work Was Accomplished*

Following selection of vehicles, the test parts were measured and/or weighed, and inspection data were obtained and recorded in a form that would readily allow a comparison with similar data obtained at the conclusion of the program.

To insure that all measurement and weight data obtained would be as accurate as possible and also that all measurements and weights would be accomplished

in exactly the same manner, these general standards were followed for all such work:

1. All parts that were to be weighed and/or measured were cleaned in accordance with the CRC-L4 procedure.
2. All parts that required a structural check were processed through the Magnaflux procedure. Any parts showing inherent structural weaknesses were discarded.
3. All weights were obtained to the nearest one-ten-thousandth of a gram.
4. All measurements taken with the vernier height gauge were to the nearest one-thousandth of an inch.
5. All measurements obtained with a micrometer were to the nearest one-ten-thousandth of an inch.
6. All parts were marked with an electric etcher for identification, designating the car number and position in which they were used on the particular vehicle.
7. In order to preclude any chance that the cleaned parts would oxidize, each of the parts was coated with the grease that was assigned it for test—immediately after the weighing and/or measuring operation was completed.

General Weight and Measurement Data

1. All parts cleaned in accordance with CRC-L4 procedure.
2. Magnaflux.
3. All weight measurement accuracy to nearest 0.0001 (one-ten-thousandth) gram.
4. All measurement accuracy with Vernier height gauge to nearest 0.001 (one-thousandth) inch.
5. All measurements (except 4 above) to the nearest 0.0001 (one-ten-thousandth) inch.
6. All parts marked for identification.
7. All parts coated with assigned grease immediately after weighing and/or measuring to preclude oxidizing.

FIGURE 8

The different types of vehicles presented distinct and separate problems when selecting the parts that would be weighed and/or measured. It was generally considered that high wear parts would be selected if at all possible. As an example, the parts selected for weight and measurement evaluation on the Fruehauf trailers are shown in Figure 9.

All measured parts were included within the tee lever and shackle assembly.

1. Each tee lever bushing was weighed. This included both the aluminum alloy and plastic bushing. This weighing operation was illustrated in an earlier slide.
2. Each tee lever hinge bolt or suspension shaft was measured diametrically, parallel and perpendicular to a slot, at two contact points for each of its four bushings.
3. Axle bracket hinge bolts were measured in the same manner as in No. 2, above, with the exception that the reference marks were the lock bolt slot.
4. The spacer washers were weighed collectively for each of the two shafts.

The driving procedure conformed to the existing fleet schedule for each type of vehicle used on the program. This phase of the investigation is composed of four major divisions; one for each of the groups of the test equipment described previously (1—Ford Passenger Car, 2—City Buses, 3—Truck-Tractors, and 4—Trailers).

**Fruehauf Trailer
Measured Parts**

1. Tee lever bushing.
2. Tee lever hinge bolt or suspension shaft.
3. Axle bracket hinge bolt.
4. Spacer washers.

FIGURE 9

Every effort was made to eliminate or cancel out any existing variable wherever possible. In this regard an attempt was made to have all of the vehicles within a particular group operate on the same or similar schedules. Pairs of identical vehicles, one assigned reference grease and the other test grease, operating on as nearly identical schedules as possible, were selected so that direct comparisons between the test grease and the reference grease could be made.

Lubrication schedules were selected in accordance with equipment manufacturers' recommendations. Each of the different types of equipment used in the program required a different lubrication schedule. As an example of the type of schedule used, the lubrication and inspection schedule for the City Buses is shown in Figure 10.

**City Bus
Lubrication Schedule**

3000 *Miles*

Grease dripping.
Lubricate Brake cams.
Lubricate steering knuckles, tie rod ends and drag links.
Check for steering and suspension stickiness—before and after lubrication.

6000 *Miles*

Steering free play.
Inspect steering gear.
Inspect drive line.
Complete chassis lubrication.

FIGURE 10

After each 3000 miles of operation the vehicles were:

1. Checked for grease dripping.
2. The brake cam actuating shafts were lubricated.
3. The steering knuckles, tie rod ends and drag links were lubricated.
4. The vehicles were checked for steering and suspension stickiness—both before and after lubrication.

Each 6000 miles of operation the vehicles were checked for the following items, in addition to those mentioned before for the 3000-mile check:

1. Steering free play.
2. Visual physical inspection of the steering gear—including joints, stops, toe-in, brackets and steering knouckles.
3. Visual physical inspection of the drive line—including bearings and end play, crosses, splines and flange bolts.
4. Lubricate entire chassis.

Wherever possible, a representative of the Institute was present for preparation and service of vehicles in the instances where the work was not done in the Institute laboratories. This was done to insure that installation techniques and procedures did not differ materially between the outside shop and the Institute's laboratory procedure. In addition to the presence of the representative, written specific detailed instructions were issued for each separate facet of the program so that all of the work would follow the same pattern and more consistent results might be obtained.

At the conclusion of all test driving the vehicles were disassembled, and the designated parts removed, cleaned and weighed and/or measured. The vehicles were reassembled with new or serviceable used parts and the test parts returned to the sponsor for possible future display purposes.

Typical of the data resulting from this program is that shown in Figure 11—which is a portion of the spring pin wear data for the International Harvester Tractors.

Spring Pin Wear International Harvester Tractors

Item		*Test Product*	*Av. Wt. Loss or Wear*	*Av. Initial Wt. or Meas.*	*Per Ct. Loss*
INTERNATIONAL HARVESTER TRACTOR					
Front					
Stationary Pin (wear)					
	Right	Test	0.00348	0.8713	0.3994
		Reference	0.03330	0.8712	3.8223
	Left	Test	0.00368	0.8713	0.4224
		Reference	0.03686	0.8713	4.2305
Frame Anchor (wear)					
	Right	Test	0.00074	0.8711	0.0850
		Reference	0.00572	0.8714	0.6564
	Left	Test	0.00011	0.8714	0.0126
		Reference	0.00455	0.8711	0.5223

FIGURE 11

IV Conclusions

In conclusion, I would like to say that the results of the road evaluation program provided the type of result desired by both the sponsoring company and Southwest Research. The detailed results of this work are property of Climax Molybdenum Company and any subsequent release of information relative to the subject test, whether it be detailed or general in nature, should come from that company.

About the Authors

E. W. TRACY, JR. *received his BS degree in petroleum engineering from the University of Texas in 1949 and his LLB degree from St. Mary's university in 1957. He is a licensed professional engineer in the state of Texas and a member of the Texas Bar. He has been with the department of engines, fuels and lubricants of Southwest Research Institute for the past seven years where he is presently senior research engineer. A specialist on automotive fuel and lubricant evaluation, he has conducted road studies totaling millions of vehicle miles.*

E. E. SMITH *is Climax Molybdenum's manager of lubricant development. He is also the company's representative to NLGI. Smith has spent most of his business life in the petroleum industry developing markets for, and selling lubricants as well as other petroleum products. Smith was previously with the Cities Service Oil Co., beginning as sales engineer for general petroleum products and progressing to sales manager for petroleum waxes and sales manager for industrial lubricants in the New York area. He joined Climax in 1955 and has been a frequent contributor to the* NLGI SPOKESMAN.

Non-Lubricated, Non-Metallic Automotive Bearings What—Where—When

By: J. W. Lane
C. F. Foell
Socony Mobil Oil Co., Inc.

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

THERE SEEMS TO be considerable apprehension among lubricating grease manufacturers and marketers about the serious threat to volume posed by the automotive vehicle which will require no "grease job." Whether the fears are justified is hard to determine, at least for the immediate period. The press has been full of such hints and reports during the past year. You have all seen them and they will not be recited in detail here. The earlier news was more optimistic, or more ominous, depending on one's interests, and the predictions were many for the "greaseless" car in 1960. More recently, a second look has been taken and the doom of automotive greases appears to have been postponed, at least for a while.

We might cite just a few press items to illustrate the confusion which has prevailed:

Motor: June, 1959, issue—"The new Triumph Herald, recently announced in England, departs from conventional British light car design by using . . . a chassis which requires no lubrication."

Product Engineering: August 17, 1959, issue, with reference to this same Triumph Herald—"Once-a-year lubrication is provided by using sealed roller bearings and incorporating lube reservoirs at critical points. Extensive use of rubber and nylon bushings has eliminated many grease fittings entirely. Yearly or 12,000-mile check is required for the wheel bearings, steering rack and pinion, fan, water pump and lower trunnions of the front-wheel spindles . . . All universal joints on the driveshaft and rear axles use sealed roller bearings prepacked at assembly."

Petroleum Marketer: August, 1959, issue—"The ardor for a lubeless chassis in the 1960 line has cooled off a bit. This is due to the failure of the suppliers to overcome some rather serious problems. But progress is reported and the project is still very much alive, so it may still come in 1961."

National Petroleum News: September, 1959, issue, with reference to the new, smaller (so-called "compact") U. S. cars—"*Grease Fittings*: The usual, with Ford abandoning for now its plan to do away with grease fittings . . . This reflects Detroit's general slowdown in a contemplated switch to lubricationless bearings on some models."

From the same source, and with reference to the big, or conventional, U. S. cars— "*Grease Fittings*: Even the Thunderbird held off on eliminating fittings. AMC is dropping some . . . Each Ford make continues with its usual number of fittings. The company isn't yet convinced that 'Teflon' bearings will stand up. American Motors, however, has made a partial switch to lube-free chassis bearings. V-8 models are now down to five grease fittings, and six-cylinder cars have six. The Rambler still has to be lifted for routine service."

There is a lot of smoke, certainly, so there must be some fire. It is our assignment to try to tell you where, and to what extent, and to do some intelligent guessing on what is most likely to happen over the very near future. To do these things, we have studied reports and talked with manufacturers, not always too successfully, because developments are still so new they are being regarded as trade secrets by some.

Defining the Area of Interest

For this paper, "non-lubricated, non-metallic" bearing means a non-metallic member which can be so interposed at customary points of movement in automotive vehicle suspensions and steering systems as to permit the required movement without the necessity of periodically adding lubricant to reduce friction and wear. Front suspensions, steering points and wheel bearings are the principal chassis areas still requiring lubrication since rear suspensions long ago went

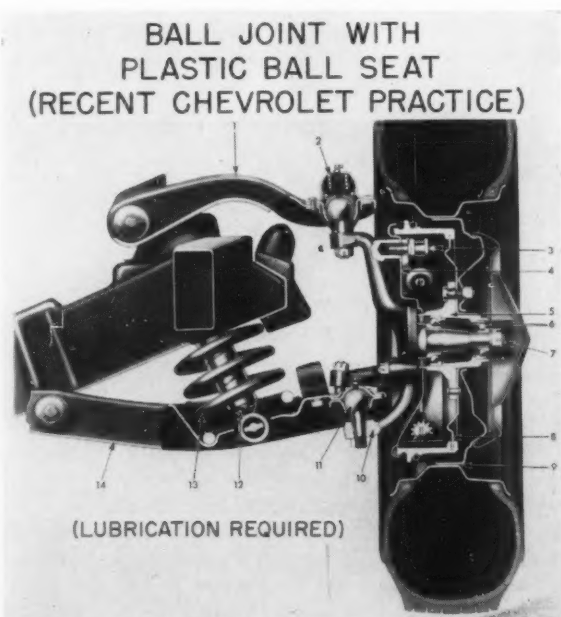


FIGURE 1

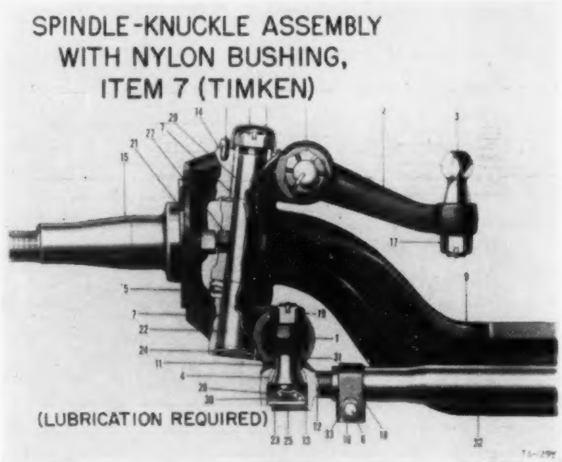


FIGURE 2

through redesigns that eliminated any need for lubrication.

While the above "definition" may seem quite narrow, it is felt vital to this discussion in that it eliminates those points which, while perhaps not requiring frequent lubrication, cannot run indefinitely without it, as evidenced by the quotation above (re the Triumph Herald). Also, there are indications that nylon and possibly some other non-metallic bearings perform most satisfactorily when relubricated regularly.

In this connection it must be recognized that use of inserts of nylon, phenolic compositions and other non-

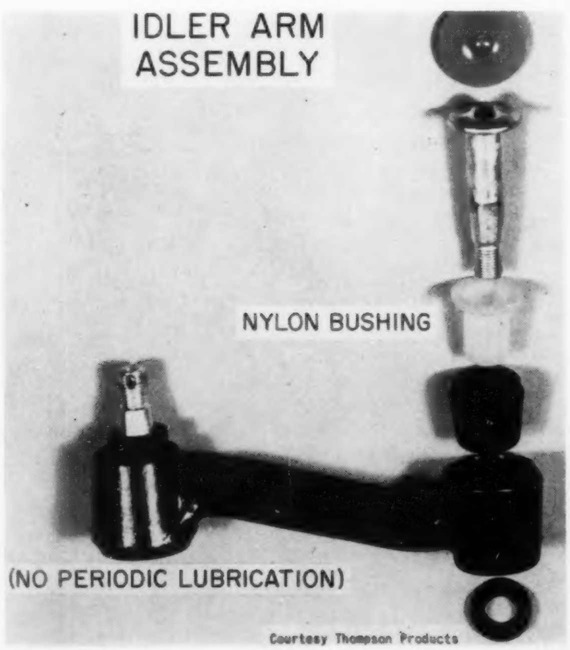


FIGURE 3

metals is not entirely new. They have been employed for several years in some points of certain front suspensions and steering linkages. In some cases, however, provision has been made for lubrication in the usual way at normal intervals. Some of the currently-used inserts, such as the nylon bushing in the Chevrolet, Chrysler and Rambler steering linkages, have no provision for periodic relubrication. On the other hand, Ford has announced that certain of its new trucks will employ Timken front axles having nylon kingpin bushings, in place of bronze, but provision for lubrication has been retained. Figures one to six, inclusive, show typical applications which either have been or are now being employed commercially. Both lubricated and non-lubricated styles are shown.

The New Bearing

The new bearing under discussion is primarily a plastic. The most frequently mentioned materials have proved chiefly to be nylon, a polymeric amide; the Du Pont tetrafluorethylene resin known as "Teflon," or as "TFE;" and the Du Pont acetal resin called "Delrin." Since the more promising results appear procurable with "Teflon," and since considerable experimental

FIGURE 4

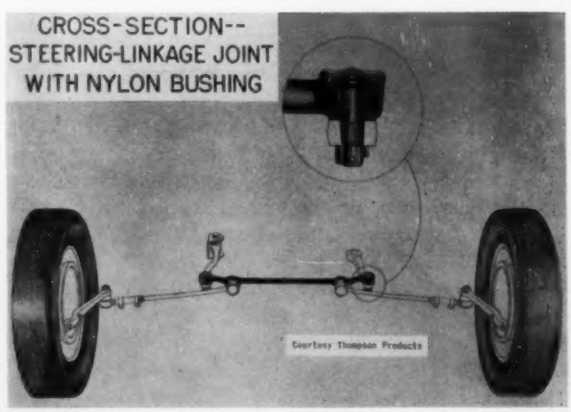


FIGURE 5

FRONT SUSPENSION LOWER-ARM BALL JOINT (1959 FORD)

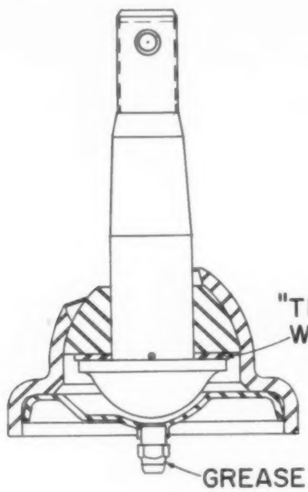


FIGURE 6

work with this plastic has been done, the remarks will be confined chiefly to this material.

"Teflon" in the as-made state is a white solid, chemically more inert than most other known materials, and possessing an unctuous, slippery feeling which results from its low-friction property and practical absence of stick-slip. Unlike nylon, it is completely resistant to water absorption, and therefore when used as a dry bearing material does not squeak when exposed to moisture or highly humid atmospheres. It may be used over a wide range of temperatures, from about –320 F. to well above 400 F. Continuous exposure to high temperatures causes gradual decomposition through vaporization, but at temperatures up to about 500-550 F. the decomposition rate is almost imperceptible.

In the fully resinous state, say as a molded sleeve bearing, both "Teflon" and nylon are restricted to rather light loading to avoid flow and extrusion which destroy bearing integrity. However, when "Teflon" is drawn into a filament its tensile strength increases remarkably and elongation and flow under load is greatly decreased, all without any impairment of the excellent low-friction and moisture-resistant qualities. The filaments or fibers can then be woven into fabric preparatory to further processing into a bearing form, or impregnated in the individual fiber state into a bearing member constructed of another material. Thermosetting phenolic resin is often used as the second member. Tables 1, 2 and 3 show important characteristics of "Teflon" and bearing conditions for which it appears suitable.

"Teflon" may be also joined to other materials, including metals, by a form of mechanical locking. The degree of adherence is controlled by the penetration of the adhering agent and the arrangements of the fibers to present a degree of mechanical lock. A glue, for example, might stick to a metal but would only lock the fiber to the extent that the fiber was curled and surrounded by the glue; the mechanical strength of the junction would depend on that of the glue. In another technique, the filament is interwoven with other fibers, say of cotton, to provide a fabric which is essentially "Teflon" on one side and the second fiber on the other side. Again, the purpose is either to assure good adhesion where joining to other materials follows,

TABLE 1

Comparison of Properties of "Teflon" Fiber & Resin & Nylon Resin

	"Teflon" Fiber	"Teflon" Resin	Nylon Resin
Density, G/CC	2.3	2.2	1.14
Ultimate Tensile Strength, lb. per sq. in.*	47,000	2,000	11,200
Elongation at break, %*	13	100-200	60-300
Initial Modulus, lb. per sq. in.*	471,000	60,000	100,000
Load Bearing Capacity without cold flow, lb. per sq. in.	60,000	2,000	5,000
Coefficient of friction, as low as	0.01	0.02	0.25

*At 70 Deg. F., 65% relative humidity.

TABLE 2

Properties of "Teflon" Fiber Useful in Automotive Bearing Applications

1. Low coefficient of friction.
2. Virtual absence of "stick-slip."
3. High resistance to cold flow under load.
4. Remarkable chemical stability.
5. Excellent thermal stability.
6. No Moisture absorption.
7. Resistance to absorption, seizure, wear.

TABLE 3

Bearing Operating Conditions Favoring Use of "Teflon" Fiber

1. No lubrication
2. Infrequent lubrication
3. High loading (but at low speed)
4. Shock and impact loading
5. Oscillation, sliding
6. Intermittent motion
7. Low temperature (down to -320 degrees F.)
8. High temperature (up to 500 degrees F.)

TYPICAL SLEEVE-BEARING CONSTRUCTION

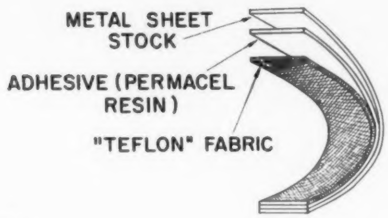


FIGURE 7

or to provide bulk and controlled porosity where reinforcement with a molded resin, again usually a thermosetting phenolic resin, is desired.

"Delrin" is also a low-friction material, with practically no stick-slip tendencies, and is strong, hard and resistant to abrasion; starting and running friction are reported to be identical. It is used in the bulk resinous state and is not drawn into a fiber as is "Teflon." It may be run unlubricated, but the maker's experimental work indicates that about an hour's soaking at 250 F. in a light neutral oil improves operation and resistance to abrasion. Apparently, there is still much to be learned about the abilities of "Delrin" as an automotive bearing material for the applications under discussion in this paper.

For sleeve (journal) bearings, "Teflon" fabric may be locked to strips of metal in a continuous process, Figure 7. The bearings are then formed by cutting off the required lengths and rolling them to the proper diameter. Or, the bearing may be form-molded by impregnating the backing material with a strong, rigid phenolic resin. This method is also used to make ball-and-socket joints for various purposes. The pressure employed in the molding process is a contributing factor to the high strength obtained with preformed "Teflon" composite bearings. Other means of manufacture, such as expansion by a mandrel of the fabric against the bore of a metal tube, are also under investigation.

SLEEVE BEARING SERVICE RANGE
"TEFLON" FIBER (NON-LUBRICATED)
CONTINUOUS ROTATION: 1000-HR TESTS

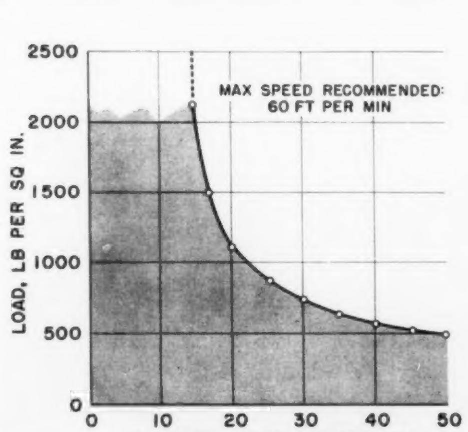


FIGURE 8

SLEEVE BEARING PERFORMANCE

1000-HR CONTINUOUS TEST

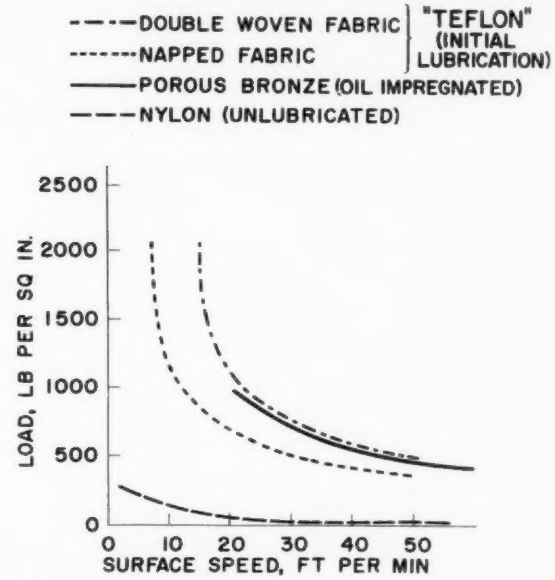


FIGURE 9

The service range of "Teflon" in sleeve bearings and a comparison with other materials are shown in Figures 8 and 9.

Some very interesting findings are reported in experimental work on conventional all-metallic, lubricated front suspensions in contrast to joints lined with "Teflon" fabric. When rotated under equal loads (1000 lb.) by a force applied at a constant rate (½ ft. per min.) the "break-away" force was about 3.7 times as much for the lubricated joint as for the "Teflon" joint; the force required thereafter to maintain motion was 5.4 times as much for the lubricated joint as for the "Teflon" joint, Figure 10. Stick-slip was evident with the conventional joint construction, but was absent with the "Teflon" unit. "Teflon" exhibits an increase in coefficient of friction as surface speeds increase, Figure 11, even at rates as low as several feet per minute, which are common in suspensions and steering assemblies. This is claimed to reduce "shimmy" and wheel-fight, the increased friction acting as a damping

FRICTIONAL PERFORMANCE OF BALL-STUD AUTOMOTIVE SUSPENSION JOINTS

1000-LB COMPRESSION LOAD--TORQUE APPLIED AT RATE OF 1/2 FT PER MIN

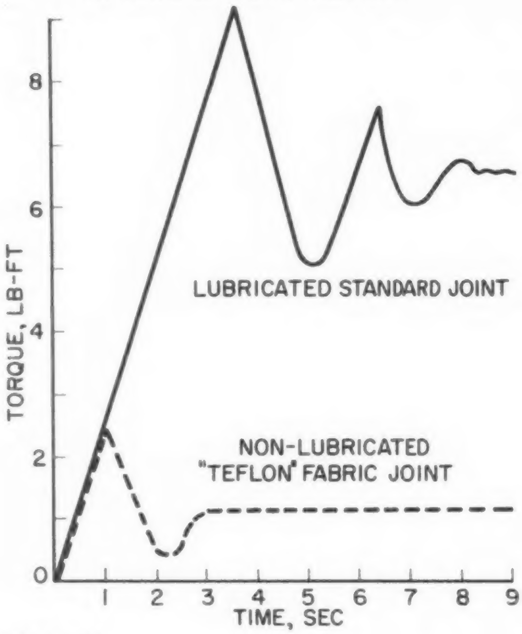


FIGURE 10

EFFECT OF SPEED & LOAD ON FRICTION

BALL AND SOCKET JOINT

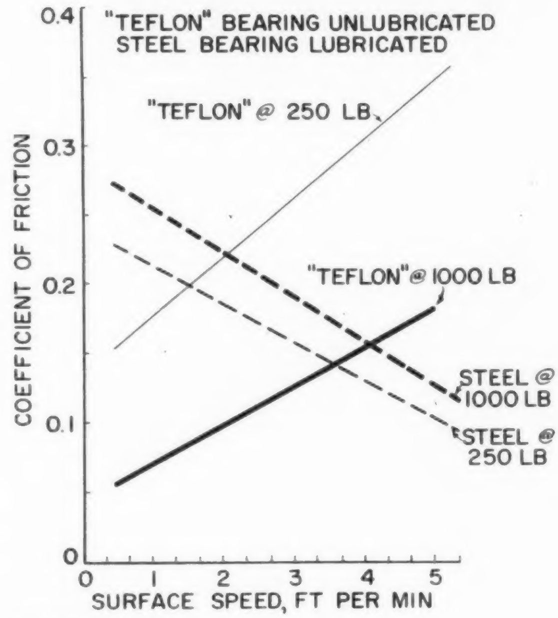


FIGURE 11

medium. These findings have been confirmed by the manufacturers of bearings incorporating "Teflon" fabric. *They offer also a challenge to the lubricating grease industry, to design a new grease with reduced stick-slip properties that can improve the operation of the conventional metallic bearing.*

It should be realized that we are here talking essentially of steering ease and riding smoothness, the qualities on which a driver partly bases his feelings of satisfaction or dissatisfaction with his vehicle.

In this connection, considerable publicity has been accorded the fleet of six Baltimore taxicabs equipped with "Teflon" bearings and subjected to 50,000 miles of service. While details of actual bearing construction have not been disclosed, it has been reported that no "Teflon" bearing showed any other sign of wear than a slight polish, and the drivers acclaimed the ease of handling and comfortable ride of their vehicles. There was of course no lubrication applied during the entire test period. These vehicles were returned to their original condition at the conclusion of the test and now operate with conventional bearings requiring lubrication

TABLE 4

Comparison of Spherical Bearings of "Teflon" Fiber & All Steel-Oscillation Tests

Load, lb. per sq. in.	"Teflon" 3,000	Steel 3,000	"Teflon" 16,000	Steel 16,000	"Teflon" 25,000	Steel 25,000
Arc of Oscillation	60°	60°	60°	60°	60°	60°
Cycles per min.	60	60	6	6	6	6
Total Cycles	1,000,000	1,000,000	65,000	65,000	6,000	—
Lubrication	Initial only	Full	Initial only	Full	Initial only	Full
Remarks	Bearing worn but still Serviceable	Shaft scored	Bearing Still Serviceable	Severe Shaft Scoring	Bearing Still Serviceable	Seized at Start-up

through fittings. An indication of what may be termed the durability of "Teflon" is given by the data in Table 4.

The bearing forms of primary interest to this paper are the ball and the sleeve. Figures 12 to 19, inclusive, are illustrative of the several principal ways in which they may be employed in automotive design. These are representative of what can be done, and do not necessarily represent actual production items. Note from Figures 12, 14 that a seal is incorporated in the assembly. This is necessary to prevent the entrance of abrasives and water, which can be harmful to the active metallic parts of the bearing, if not to the "Teflon" itself. From conversations, it is concluded that "greaseless" bearing designs which do not provide for adequate sealing can be expected to show up poorly in service. It also appears that packing with lubricating grease during assembly may be of material assistance to the sealing function.

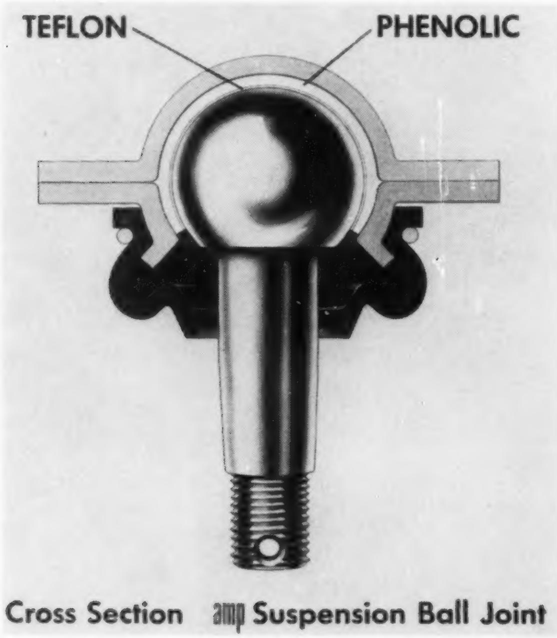


FIGURE 12

FIGURE 13

FIGURE 14

FIGURE 15

FIGURE 16

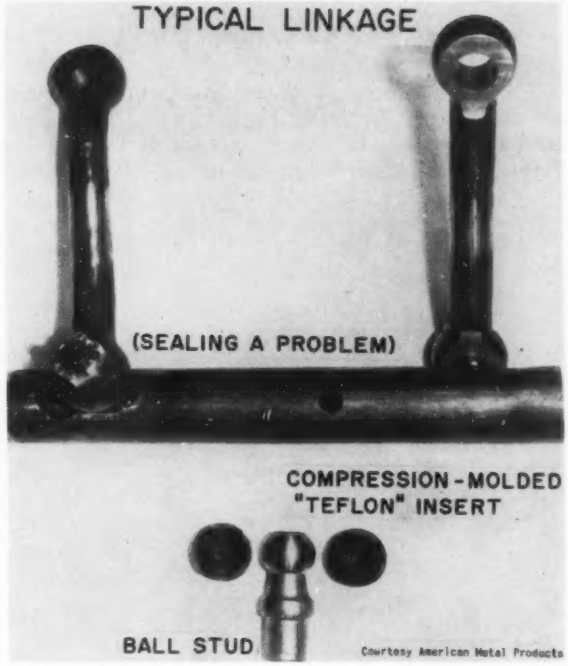


FIGURE 18

FIGURE 17

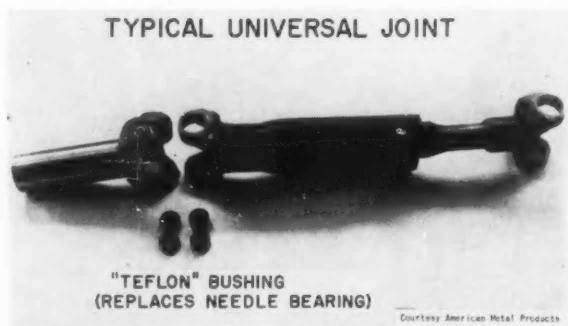


FIGURE 19

Commercial Application

At the Annual Meeting last year, W. M. Drout, Jr. stated:[1]

"The perfect solution to most greasing problems, particularly that of recurring greasing, would be the development of a low cost, long life, frictionless bearing, which could be sealed against the intrusion of foreign bodies. In many ways the successful attainment of this solution would seem impossible . . . It is quite difficult to estimate when, or if, a technological breakthrough permitting the elimination of grease fittings will occur, and whether it will occur in one step or a series of steps. The experts, namely the automobile manufacturers, feel rather strongly that complete elimination of fittings is only a matter of time. The more optimistic feel that this will occur within three years. The more conservative feel that this will take place within five years."

It seems that the above brief specification for the ideal "greaseless" bearing is reasonably well satisfied by

1. "Market Potential for Automotive Grease," by W. M. Drout, Jr., Esso Standard Oil company.

"Teflon" as far as its physical properties are concerned. Adequate "Teflon" bearings, equipped with seals where necessary, are indicated to be more costly than conventional metal-to-metal joints. This may be an important reason why their wide-scale commercial adoption has been delayed.

What About the Car Owner?

It is pertinent to inquire if the motorist can be served most effectively by the "greaseless" car. While the idea of no expense for several grease jobs each year undeniably has an economic appeal, he may be made to suffer in other ways. Who is to perform the safety inspections which have accompanied every good grease job, to warn him of a bad tire, a frayed hydraulic brake line, a cracked or badly-corroded exhaust muffler or tail-pipe, a broken spring, worn shock-absorber bushings, a steering system component on the verge of failure, or loose or missing nuts and bolts in general? These are matters which affect his personal safety, and that of his car, Then, too, there are the other necessary services, which while not directly affecting safety, cannot be ignored—battery and cooling system condition; generator, distributor and, possibly, water-pump lubrication.

Admittedly, the number of highway accidents definitely chargeable to failure of vehicle components is hard to appraise accurately. We quote[2] "Precise identification of vehicle factors with highway accidents is especially difficult. As indicated earlier, the vehicle is commonly thought to be involved as a contributing cause in only a small percentage of accidents, but this is due at least in part to destruction or inaccessibility of the evidence after the accident."

Again, from the same source: "Vehicle condition is the key factor concerning vehicle breakdowns on the highway, regardless of whether or not the breakdown results in an accident. Drivers are often unaware of critical vehicle condition because they seldom check for other than obvious deficiencies. State inspection systems are therefore desirable, for they guarantee that vehicles meet certain specified criteria at periodic inspection times. While this does not always assure that critical deterioration of some vehicle part could not take place in the interval between inspections, even infrequent inspection by competent mechanics is bound to be beneficial."

Notice in the latter quotation the emphasis on "inspection by competent mechanics."

The car owner, once his car is outside the warranty period, patronizes service stations to the virtual exclusion of the car dealer, until such time as a major repair is necessary. So, if he does not see the car dealer, and stops into the gas station only for fuel and an occasional oil change, who is to inspect and when?

2. The Federal Role in Highway Safety; 86th Congress, 1st Session, House Document No. 93.

The following data were compiled[3] from those States where *all* cars must be inspected annually; included were 10 States and the District of Columbia:

	VIOLATION			
No. of Inspections	*Brakes*	*Head Lights*	*Rear Lights*	*Exhaust Systems*
8,298,000	1,722,400	1,633,400	1,649,500	1,148,500

3. National Safety Council's Traffic Department Report of March 31, 1959, derived from 1958 Traffic Safety Inventory Reports.

Each of the several types of violations is an appreciable percentage of the total inspections, and each concerns a vehicle component which can play a major role in accidents and breakdowns. No other conclusion is possible but that inspections reduce accidents and breakdowns due to equipment factors. If the opportunities for inspections are decreased for any reason, then accidents are bound to increase. Car manufacturers can take credit for increased attention to safety in car design, but they may be offsetting this advance by reducing the chances for inspection by qualified mechanics, whether they be car dealers or service station operators, in their attempts to produce the "greaseless" automobile.

The Immediate Future

Now, as to the picture that emerges for the next year or so, possibly even longer: new materials and fabrication technologies appear able to provide bearings which will truly be "greaseless" throughout their life, but in a highly competitive field such as the Automotive industry, their widespread use may not be achieved immediately, for both cost and marketing reasons.

Manufacturing costs are under constant scrutiny, for even a small increase is multiplied several times over at the retail level; after all, the 1960 model year is supposed to be another "economy" year, as far as appeal to the prospective customer is concerned. Along marketing lines, manufacturers cannot afford to risk an unsatisfactory "greaseless" development — they may have their hands full with the new "compact" cars and the "economy" features planned for the established lines. We sense a rather general feeling *at the moment* on the part of automotive people that even the new types of bearings under discussion will work better and last longer if initially greased, and that any need for subsequent regreasing will depend greatly on how well the assembly can be sealed against the entry of contaminants. Adequate sealing can be proportionally an expensive component of a complete non-metallic bearing assembly. Thus, much more experimentation and field testing seem indicated. However, a rather general use of non-metallic bearings may prevail for the 1961 models; whether they will be truly "greaseless" appears to be the big question.

We see no immediate adverse effect on automotive grease volume demand; as a matter of fact, it could go up a bit due to vehicle population growth, even though the gradual decline in fittings, which began

some years ago, still continues. One factor which is ever present, and does not improve, is the average motorist's indifference, lethargy and inertia as to lubrication scheduling for his car. Sales of automotive lubricants for all purposes have been hard hit during the past decade purely because of this "don't care" attitude. In this connection, we may as well face facts and recognize that the grease market as represented in current vehicle designs could stand some effective cultivation—the potential is not being realized. *Lubricating grease marketers should strengthen their efforts toward publicizing and promoting the advantages of frequent lubrication and in educating dealers and car owners in the benefits therefrom.*

On the other hand, we are inclined to agree with those who predict the successful advent of the "greaseless" car in the next three to five years, in the full knowledge that "greaseless" to many in the automotive industry means cars which will be able to operate without any re-greasing for mileages ranging from 25,000 to 100,000 miles. As such cars increase in registration, the grease industry may expect its sales for automotive use to decline in proportion. Further, there is no apparent technical reason presently discernable that precludes the "non-lubricated, non-metallic" bearing for commercial vehicle use; its adoption in this area would accelerate the decline in automotive lubricating grease volume.

We cannot foresee just where automotive grease volume will stabilize, if ever. It appears likely that it will go down. Until someone proves otherwise, we are willing to accept Drout's conclusions that the decline, say in 5 years, can be substantial, *unless the industry is successful in instituting new products and applications that will be effective in reversing the trend.* While it may be hoping for too much, manufacturers might come to see substantial safety values in the opportunity for checks and inspections offered by regular lubrications, and as a result slow down on the "greaseless" car goal. From where we stand now, however, the "greaseless" bearing shows every indication of eventually becoming another serious bar to the maintenance of grease volume in the amounts to which we have become accustomed.

Conclusion

We have been fully conscious of the possibility that this paper could be out of date virtually on its completion. This is the ever-present risk when dealing with a new subject which has received wide but incomplete publicity (how much of which is based on rumor and guesswork no one knows) and where the experimental work has been progressed down different avenues by several investigators, some of whom still catalog their findings in the category of trade secrets. Only time will tell if we have been even reasonably correct as to the deductions reported here.

There is a challenge to the lubricating grease industry to develop and put in widespread distribution greases which in conjunction with metallic bearings will do a better job than the non-lubricated bearing.

We do wish to take this opportunity to acknowledge the helpful cooperation of A. O. Melby, D. G. Bannerman and T. B. Gage of Du Pont; Paul P. Thomas of American Metal Products; E. L. Mosshamer, Socony Mobil headquarters automotive engineer resident in Detroit; and others who, while remaining anonymous, have contributed in some measure through their ideas and comments regarding future developments.

About the Authors

J. W. Lane *received his BS degree from Massachusetts Institute of Technology in* 1931 *and an MS from the same institution in* 1934. *Between these years he taught engineering subjects at MIT while at the same time gathering automotive experience at Franklin Motor Car company's Boston branch and at Ford's Somerville, Mass. plant. He joined the New England division of the Socony Mobil Oil Co., Inc. in* 1934, *subsequently becoming chief automotive engineer for that division in* 1937. *In January,* 1959 *he was named manager of the program division of the products department, the position he now occupies. He has devoted much time to NLGI as a director since* 1952 *and serving as the Institute's 24th president in* 1957.

C. F. Foell *graduated from Syracuse university in* 1926 *with the degree of mechanical engineer. After a period in the power-equipment and machine-tool industries, he entered the oil business in* 1929 *and spent ten years in the marketing of industrial and automotive lubricants. He then did vocational educational work for the state of New York and also served five years as editor of the trade paper,* Diesel Power. *He joined Socony Mobil Oil Co., Inc. in* 1945 *as an engineer editor and is at present a senior editor in the products department of that company.*

Literature and Patent Abstracts

Gear Lubrication

The Wright Air Development Center Gear Lubrication and Development Program.

H. R. Smith, *Lubricating Engineering* July 1959, p. 290-294.

The investigations underway are outlined and a description of the apparatus and test procedures is given. However, no conclusions are drawn as to the effect of lubricants.

A graph shows the effect of flow rate on gear scuffing and from this it is evident that as flow rate decreases scuffing increases. A standard flow rate of 270 ml. per minute has been set but apparently this is too low.

Another graph plots oil temperature vs. percent scuff over a range of 165 to 280 F. With the lowest load the scuffing increases about 10 percent over this range but with the highest load the increase is only about 3 percent.

A statement of interest is "Subsequent data as well as that presented here has shown that viscosity has little effect on the fatigue life of gears."

Solid Lubricant

Preparing Lubricative Crystalline Molybdenum Disulfide

According to Spengler and Hohn (U.S. Patent 2,892,741, assigned to The Alpha Molykote corporation) lubricative crystalline molybdenum disulfide can be prepared in powder form as well as in situ on a bearing surface by sulfiding a molybdenum-containing material in an alkaline medium.

The molybdenum-containing material may be the metal or an alloy, or a compound, such as an oxide, a salt of molybdic acid, a molybdenum halide or mixtures of such compounds. For the alkaline medium, sodium and potassium hydroxides and carbonates are preferred.

For example, one mol of molybdenum trioxide, two mols of sulfur and one-half mol of potassium carbonate were heated to 475° C. in a closed crucible. After the mix-

ture had been heated for three hours most of the molybdenum was present as a disulfide. After washing with water, followed by extraction with carbon disulfide, a gray lamellar powder was obtained which had an appearance and properties very similar to those of natural, purified molybdenite.

Process

Process for Preparing Synthetic Ester Based Lubricating Greases

Complex lubricating grease compositions having little tendency to harden on storage are described by Morway (U.S. Patent 2,892,777, assigned to Esso Research and Engineering Co.). The suggested process consists of first thickening a synthetic lubricating fluid with a complex of a low molecular weight acid salt and a high molecular weight acid soap, wherein the mol ratio of the acid salt to the acid soap is below 10 to 1. Such a composition, which may contain 20 to 30 percent of thickener, is allowed to remain quiescent until it has attained its maximum degree of hardness. This hardened lubricating grease is then blended with a minor amount of additional synthetic oil to give a mixture containing 5 to 30 percent of thickener. Finally this diluted mass is subjected to the action of high rates of shear in the order of about 250,000 to 750,000 reciprocal seconds and at a temperature below 200°F. to give a finished lubricating grease.

For example a base grease was made from 16 percent glacial acetic acid, 8 percent hydrogenated castor oil, 12 percent hydrated lime, 1 percent phenyl alpha naphthylamine and 63 percent diisooctyl azelate. All of these ingredients except the acetic acid and the oxidation inhibitor were charged to a grease kettle and warmed to 150°F. Then the acetic acid was added and the mass was heated to 500°F. After cooling this mass by stirring to 250°F. the phenyl alpha naphthylamine was added and the grease was further cooled to 200°F. After standing in the kettle overnight, followed by homogenization the unworked penetration of the product was 139 and the worked penetration 297. At the end of three days the respective values were 195 and 225 and after sixty days the unworked penetration was 163 and the worked penetration 201. At the end of seventy-six days there was little further change.

Morway states that after one month's storage or sooner the penetration has stabilized. After this time the base grease was cut with further diisooctyl azelate in proportions of 30 and 20 percent. Caution is given that any increase in temperature over 200°F. during any manufacturing process will again result in the product becoming storage unstable. To illustrate the penetration stability of the aged

product cut with 30 percent additional fluid the immediate unworked penetration was 285 and the worked penetration 300. This mixture after 16 days storage had an unworked penetration of 275 and a worked penetration of 295.

The final lubricating grease had a dropping point above 500°F. In a bearing test at 250°F. and 10,000 rpm the product had a life of 480 hours when the test was discontinued without failure.

In similar compositions, where the mol ration of the salt to soap differed E. P. values of 33.6 and 55 on a 4 ball test are shown.

Processing

Low Temperature Method for Preparing High Temperature Greases

A method is suggested by Carter and Dreher (U.S. Patent 2,892,778, assigned to California Research corporation) by which lubricating greases having dropping points in excess of 500°F. can be prepared by heating the components to temperatures no greater than about 200°F. Such processing refers to products in which the thickener is formed by the reaction of an acid and a metal base.

First, the thickener acid is dispersed in the base oil, after which a solution of the metal base is mixed with the oil-acid blend, preferably at room temperature, and at a temperature no greater than 200°F. This mixture is then heated, with agitation, to a maximum of 250°F. but preferably no higher than 220°F. This heating is primarily for the purpose of obtaining a uniform blend but during this step the solvent for the metal base may also be removed. Next, the mass is cooled below 200°F. and preferably below 175°F. Finally, the mixture is subjected to a shearing force by passing through a Manton-Gaulin Homogenizer, an Eppenbach colloid Mill or a Cornell Homogenizer. Other types of milling equipment or even high-speed gear pumps can be employed for the shearing action.

The authors are particularly concerned with formation of lubricating greases in which the thickener is a terephthalamate. Thus, a mixture, consisting of methyl, N-octadecyl terephthalamate, an aqueous slurry of sodium hydroxide and a California solvent-refined oil having a viscosity of 480 SUS at 100°F., in which the grease-thickening agent comprised 10 percent by weight gave the following results. When the mixture was heated to 175°F. before being milled, the unworked penetration was 174 and the worked penetration 265. The dropping point was above 500°F.

A mixture of 250 grams of hydroxy-stearic acid, 41.5 grams of lithium hydroxide monohydrate in 250 grams of water, and 2208.5 grams of the oil used in the previous mixture was heated to 180°F. while being mixed. After being cooled to 125°F. the mass was passed through a Manton-Gaulin Homogenizer at the rate of three pounds per minute at a pressure of 4000 psi. The exit temperature was 185°F. The finished product had a worked penetration of 264 and a dropping point of 430°F.

Analysis

Development of Schematic Analytical Procedures for Synthetic Lubricants and Their Additives:

Part 4-Laboratory Manual for the Analysis of Synthetic Lubricants, Greases and Their Additives. F. S. Bonomo and J. J. E. Schmidt, July 1957, 296 pages.

This book can be secured by ordering PB 131414 from OTS, U.S. Department of Commerce, Washington 25, D.C. The price is $6.00.

The manual outlines non-optical, non-instrumental techniques for the analysis of synthetic lubricants, greases, and their additives and is designed to serve as a guide in laboratories lacking either modern analytical equipment or personnel trained in the use of such instruments. Most of the methods use simple wet chemical manipulations, or such techniques as adsorption or partition paper or column chroma-

tography. Detailed explanations are provided, including drawings and photographs of equipment where necessary. The methods are patterned after the format of Federal Test Method Standard No. 791 and, in most instances, can be modified or otherwise adapted for use with newly developed compounds.

Composition

Turpentine-Unsaturated Dicarboxylic Ester Adducts

Dazzi in U.S. Patent 2,867,648, assigned to Monsanto Chemical company, describes products, obtained by heating turpentine and either fumarates or maleates, which range from highly viscous to semisolid or waxy materials.

While it is stated that such products can be employed as thickening agents in greases, no illustrations are given of such usage. A typical preparation consisted of 388 grams of n-butyl maleate, 462 grams of wood turpentine and 1 gram of ditert-butyl- catechol which were heated in a stainless steel vessel for twelve hours at 220°C. Material boiling below 230°C. was then removed by distillation to give 95.4 grams of a desired residue.

Waterproof Silica-Base Greases

According to Martinek (U.S. Patent 2,891,010, assigned to The Pure Oil company) silica-thickened lubricating greases of improved water resistance are obtained if there is included in the composition 9 to 10 percent by weight based on the silica, of a waterproofing agent consisting of 4 to 10 parts of an oil-soluble alkylaryl polyether alcohol, prepared by condensing an alkyl phenol and ethylene oxide, and one part of an oil-soluble aliphatic monoether of a polyoxyalkylene glycol, prepared by the addition of a monohydroxy aliphatic alcohol to 1,2 propylene oxide.

A typical lubricating grease was made from 9.0 percent of Santocel ARD, 0.72 percent of Ucon-LB-55, 0.09 percent of Triton X-45, and 90.19 percent of a 91 V.I. bright

stock having a viscosity of 164 SUS at 210°F. This lubricant, which had a worked penetration of 282, showed a 15 percent loss on a water washout test.

Lubricating Grease Thickened With Ultramarine Blue

Lyons and Odell (U.S. Patent 2,892,776, assigned to Texaco, Inc.) find that if 5 to 45 percent of ultramarine blue is used to thicken lubricating oils the finished product has better E.P. qualities than conventional soap-thickened lubricating greases. In addition 5 to 15 percent of ultramarine blue can be added to aluminum, calcium, sodium or mixed base soap thickened lubricating greases.

Ultramarine blue is a double silicate of aluminum and alkali metal containing chemically combined sulfur. The pigment should have a fineness of 0.05 to 3.0 microns in diameter. Milling of some type, with or without heat can be used to form the lubricant.

A typical lubricating grease was made from an oil of 300 SUS at 100°F. oil and 30 percent by weight of the pigment. After passing through a Premier Colloid Mill a soft blue lubricating grease was formed which had a dropping point above 500°F., a worked penetration of 343 and a penetration after 100,000 strokes of 360. This was OK on a Timken load of 20 pounds and had a Mean Hertz Load of 36 kg. at seizure.

Additives may be included in such lubricating greases but the product described above without the presence of an oxidation inhibitor had a six pound pressure drop in 100 hours in an ASTM Bomb Oxidation Test.

Synthetic Oils As Raw Materials for the Production of Lubricating Oils and Greases

V. Rodzaevskaya and N. P. Bilik. *Novosti Neft. Tekh., Neftteperera-botka* 1956, No. 4, 11-3; C. A. 53, 13567-g.

Various esters were considered as lubricants in a new-type refrigerator. Since dioctyl phthalate had a higher viscosity than most of the fluids and showed less wear than commercial refrigerating oils it was chosen. This synthetic also had good low temperature properties and low solubility in Freon. A lubricating grease, for use as a packing product, was made from dioctyl phthalate and 8 to 12 percent of ethylcellulose. This lubricant had satisfactory plasticity and vacuum characteristics and has been in use for over three years.

Silicone Lubricating Greases

British Patent 809,731, issued to Midland Silicones, Ltd., states that the addition of 0.02 to 0.06 percent of benzotriazole to organosiloxane lubricating greases makes the products less corrosive to both copper and steel. Additional protection is provided by the further addition of 0.01 to 0.5 percent of an anhydride of alkylsuccinic, alkenylsuccinic, alkylglutaric, or alkenylglutaric acids in which the alkyl or alkenyl radicals contain 8 to 23 carbon atoms.

Thus, a lubricating grease was made from 250 parts of a dimethyl polysiloxane having a viscosity of 800 centistokes at 25°C., 29 parts of Santocel, and 0.1 part of benzotriazole by mixing on a 3-roll mill. A similar product was made omitting the last ingredient. Copper strips coated with the two lubricating greases were immersed in distilled water at 70°C. for four weeks. Use of benzotriazole completely prevented corrosion.

Soap-Thickened Lubricating Greases Modified With Glycerine Ester of a Low Molecular Weight Carboxylic Acid.

According to Vesterdal (U.S. Patent 2,892,781, assigned to Esso Research and Engineering Co.), addition of 0.1 to 2.0 percent of a glycerine ester of a low molecular weight acid to lubricating greases

thickened with complex soaps reduces the hardening effect of mechanical working of such lubricants.

The preferred ester is triacetin and the complex thickener is that formed by the alkali fusion of rapeseed oil. For example a lubricating grease was made from 18 percent rapeseed oil, 0.8 percent petroleum sodium sulfonate, 3.97 percent sodium hydroxide (used as a 40 percent solution), 1 percent triacetin, 74.72 percent naphthenic type oil having a viscosity of 50 SUS at 210°F., 1.01 percent phenyl alpha naphthylamine and 0.5 percent disalicyl aldehyde propylene diamine. The first four ingredients and about one-third of the oil were mixed and heated to 300°F. Then 13.8 percent more oil was added and the heating continued to a maximum of 470°F. The remainder of the oil was added at this temperature after which the mass was cooled to 260°F. at which point the inhibitors were added. Mixing was continued while cooling to 185°F. at which temperature the lubricant was packaged.

Another lot of the product was made containing no triacetin. The respective worked penetrations of the two lots of unhomogenized lubricating greases were 200 and 285. After homogenizing the respective worked penetrations were 189 and 188. Therefore the decreases in worked penetration on homogenizing were 11 and 97 mm/10.

Industry News

Jesco Employs Six New Grease Kettles

Jesco Lubricants company of North Kansas City, Missouri has announced that six new kettles are now in operation, according to C. L. Johnson, president.

Four are grease kettles heated by hot oil, Johnson said, while two others are liquid blending kettles. This expansion will allow the firm to produce special greases, wetting agents and gear lubricants, in addition to the regular Jesco production runs. The production increase in capacity is 50 per cent, he added.

Jesco is celebrating its 30th anniversary now, for it was on August 8, 1929 that this firm began its operations.

Shaffer Reports on Petroleum Packaging Committee Meeting

The Petroleum Packaging Committee met in Port Arthur October 12 and 13, 1959. Some items discussed were reported by the Institute's representative, T. S. Shaffer, as follows:

1. *Light Gauge Packages*

a. Standardization — An American Standards Association Sectional Committee MH2 has been working on revisions in the standards for the present weight drums and pails. The agreed upon revisions are now being considered by ASA. PPC thinks new revisions, concerning the use of lighter gauge metal, should not be proposed until after ASA approves the revisions they are now considering in standard-weight steel packages. Meanwhile, additional companies are being urged to make trial shipments of the lighter gauge pails and drums, especially those having the proposed reinforcing beads or hoops.

b. Five-Gal. Pails — The handle and ears of the present lug-covered pail may impinge on adjacent pails, to cause damage in shipment. Shipping damage can be substantially reduced by using a redesigned handle and grip, such that there is contact between pails at the beads only, there being no other impingement. This design is made possible by (1) lowering the top bead (to 3¼" below the pail top), and (2) raising the loca-

tion of ears to the level of the present top bead. The design includes plastic grips contoured to fit the sides of the pails.

PPC urges companies to try shipping 26 gauge LC pails, with the top bead lowered and with the new handles and grips. PPC will furnish detailed sketches of the proposed pail to member companies interested. If the pail with two beads is used, the second bead costs about 2 cents extra per pail. But the savings in using 26 instead of 24 gauge metal will offset the cost of the second bead.

2. *Shipping Cases*

a. Diagonal Pack 28/1 Quart Cases — Socony has been contacting equipment manufacturers, on the possibility and cost of altering present packing machines to use the diagonal pack. The Standard Knapp packer can be altered for about $3500. The Burt packer cannot be modified, but a new packer designed for the job will cost about $5400. Some 10% saving is indicated in using the 28/1 quart case (7 gallons vs 6 gallons for the 24/1).

b. The military is interested in a new diagonally slotted, rectangular case. It appears to have some advantages and some disadvantages. The case will be studied further.

c. Standard dimensions for shipping cases are expected to be approved as an American Standards Association standard within the next month. A standard method of measuring the inside dimensions of fiberboard boxes is to be published by the Packaging Institute in about a month.

3. *Grease Drums and Cans*

a. The 400 Lb. Full Removable Head Drum has a larger ocean cube than it would have if the outside diameter of the retaining ring could be reduced. Possibilities of redesign are being studied.

b. American Standards Association individual standards are supposed to be reviewed each five years. ASA Standard Requirements for Grease Cans, B64.4-1954 is up for review. There is some doubt that the five-Pound Grease Can standards should be continued, as cans conforming to the standards are not being manufactured generally.

Du Pont Markets "Ortholeum" 302 Antioxidant

A new general purpose, ashless antioxidant based on a mixture of aryl amines now is available from the DuPont company for use in greases, turbine and crankcase oils, and ester lubricants.

To be marketed as "Ortholeum" 302 antioxidant, the compound when used as a stabilizer in synthetic lubricants, effectively inhibits viscosity change, copper corrosion, and acid number increase in high temperature oxidation tests. In automobile engine and laboratory bench tests, the new product reduces bearing corrosion, oxidation, and acid formation in mineral and synthetic oils as well as greases.

"Ortholeum" 302 antioxidant, according to DuPont's petroleum chemicals division, generally is effective at low concentrations.

People in the Industry

Southwest Announces Two Appointments

H. A. Mayor, Jr., executive vice-president of Southwest Grease & Oil Co., Inc., has recently announced the appointment of Don Ricketts as the company's sales representative for the north central states area, replacing Ross Burns, who has become sales manager for the West Oil company, Kansas City, Missouri.

Mr. Ricketts joined Southwest, August 1, 1959, and has completed an extensive company-training program prior to assuming territory responsibilities. This training further supplements his eight and one-half years' oil marketing experience, including six years as sales representative with Standard Oil (Indiana) and two years as special petroleum fieldman with Consumers' Cooperative of Kansas City.

He is a 1949 graduate of Iowa State; and he, his wife, Betty, and their four children make their home in Ames, Iowa.

In addition to Mr. Ricketts' sales appointment, Mr. Mayor also announced the following appointment:

Mr. Ralph C. Axsom has been appointed as the company's eastern sales representative, replacing Wilson Simmons, who recently joined the National Sales, Inc., of Wichita, Kansas, as vice-president of sales.

Ralph joined Southwest, August 31, 1959, and has completed an extensive company-training program prior to his assuming territorial responsibilities.

This training further supplements his six and one-half years' marketing experience with Sinclair Oil company as a lubrication engineer. Ralph is a native of Kansas City and holds a mechanical engineering degree from the Missouri School of Mines, Rolla, Missouri. He has had several years' mining experience in addition to lubrication sales work. Ralph's lubrication experience in

the industrial, automotive, construction, marine, and agricultural fields will lend valuable service to Southwest customers.

Ralph, his wife, Nancy, and their four children presently reside in Omaha, Nebraska. He is a Naval air corps veteran from World War II and is presently a member of the American Legion.

In addition to these sales appointments, Mr. Mayor also mentioned that Southwest had officially completed their 1959 fiscal year on September 30. He was able to announce only partial results of their "Sell Like 60 in '59" campaign, but exclaimed that 1959 had every indication of being a record year in all departments for the 26-year-old company. He stated he felt the basic reason for the successful year was due largely to the increased volume by Southwest customers. Mr. Mayor said that many Southwest customers had been able to break into new markets with many of the new products and packaging techniques offered to them during the year.

He outlined several new projects now underway at the plant site in Wichita that will further increase Southwest customer services. They are:

1. Work is under way to build an additional 5,000 square feet of new office facilities. The new office, made necessary by progressive company expansion, will be the new home of the sales, service, and accounting departments.
2. Initial installation of an all new IBM department. With this added facility, Southwest will be better able to render prompt and accurate service to their customers everywhere.
3. The company has purchased property adjacent to the present plant site which will become the new home of the shipping department. Construction will begin in this area immediately after completion of the new office building.
4. Installation of an all new automatic filling machine capable of multi-packaging brake fluid. The machine is designed to package brake fluid in one-half pint bottles up to one-gallon containers—glass or metal.

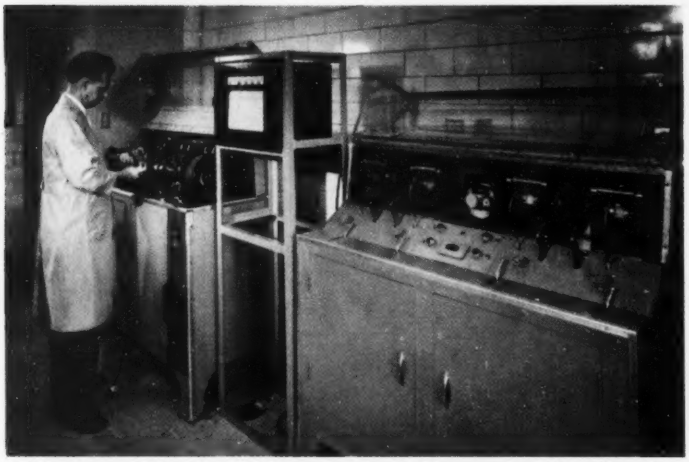
Mr. Mayor mentioned these important changes now in process, with more slated for 1960. He emphasized that Southwest continues to expand their existing services to better provide their customers with the very finest in lubrication from the "House of 'Good' Grease."

E. E. Smith Named Chemical Division Manager

E. E. Smith has been appointed manager of Climax Molybdenum company's chemical division, it was announced by Reuel F. Warriner, vice president—sales.

In his new post, Mr. Smith will direct all chemical sales and de-

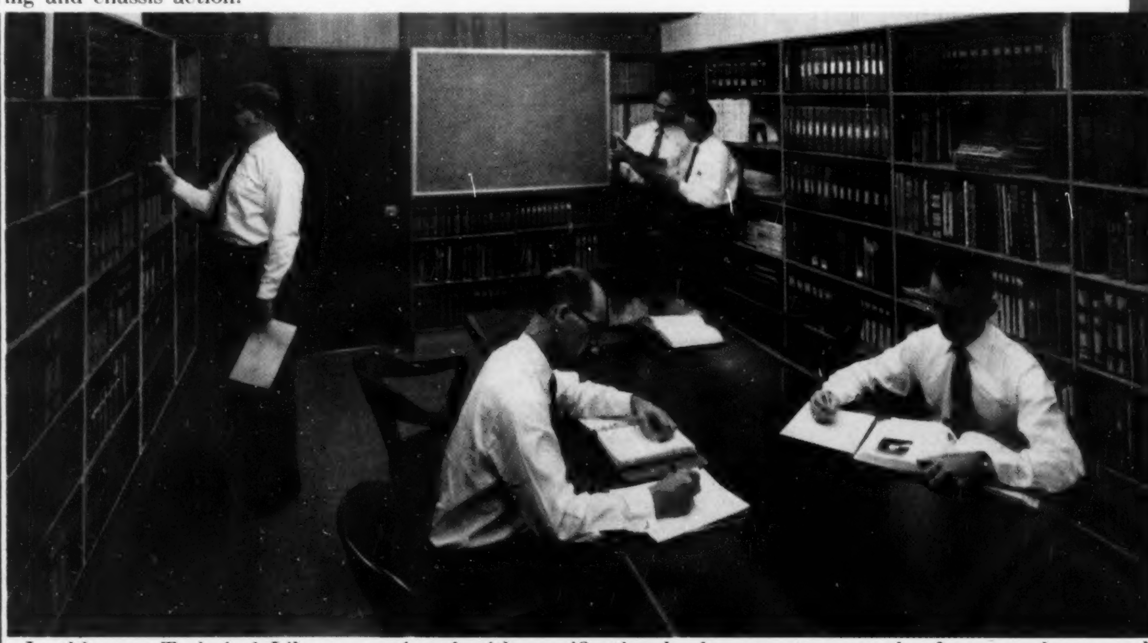
INTERNATIONAL LUBRICANT'S SCIENTIFIC CURIOSITY GIVES YOU FINER GREASES



Often International scientists develop their own specialized testing apparatuses such as these Oscillating Friction machines which duplicate the gruelling driving conditions of automotive front end, spring and chassis action.

Checking, testing, developing new greases and new ways to improve present greases has been a never-ending research assignment at the International Lubricant Corporation.

This year, International celebrates its 30th Anniversary with the opening of a great new research laboratory rededicated to the policy of guarding quality and the development of new products . . . to give you newer and finer greases for today's automotive, aviation, marine, industrial and high-powered missile equipment.



In this new Technical Library, equipped with specification books, reports, general reference volumes and periodicals, essential literature research is completed before laboratory investigation is started.

INTERNATIONAL LUBRICANT CORP.

NEW ORLEANS, LOUISIANA

Manufacturers of top quality lubricants: Aviation • Industrial • Automotive • Marine

With Research Comes Quality, With Quality Comes Leadership

velopment activities for Climax. This covers a wide range of materials including: lubricant additives; catalysts; pigments; corrosion inhibitors; agricultural chemicals; and numerous intermediate and development chemicals.

Mr. Smith previously served the company as manager of chemical sales, a post he held for two years. He joined Climax in 1955 as manager of lubricant development and was responsible for the introduction of Molysulfide additive to the chassis grease market as well as several new industrial fields. Active in the petroleum and chemical industries for ten years now, he began his career with Cities Service oil company where he was concerned with sales activities for waxes, industrial lubricants, and numerous other petroleum products.

Mr. Smith's professional affiliations include: the American Chemical Society; American Society of Lubricating Engineers; American Petroleum Institute; National Lubricating Grease Institute; and the Society of Automotive Engineers.

Wallace & Tiernan Augments Harchem Division Staff

Five additions to Harchem staff personnel are announced by Charles H. Rybolt, vice president in charge of chemical divisions for Wallace & Tiernan.

William C. Wiley has been appointed product development manager. He brings with him eighteen years of experience in research and product development in the fields of polymers and chemicals with such companies as General Tire, Borden, Reichhold and Nopco.

William G. Paul joins Harchem as representative for fatty acids in the Illinois, Missouri and Wisconsin area. A graduate of Northwestern university, Mr. Paul was formerly associated with Victor Chemical Works, E. F. Drew & Co. and Van Ameringen-Haebler.

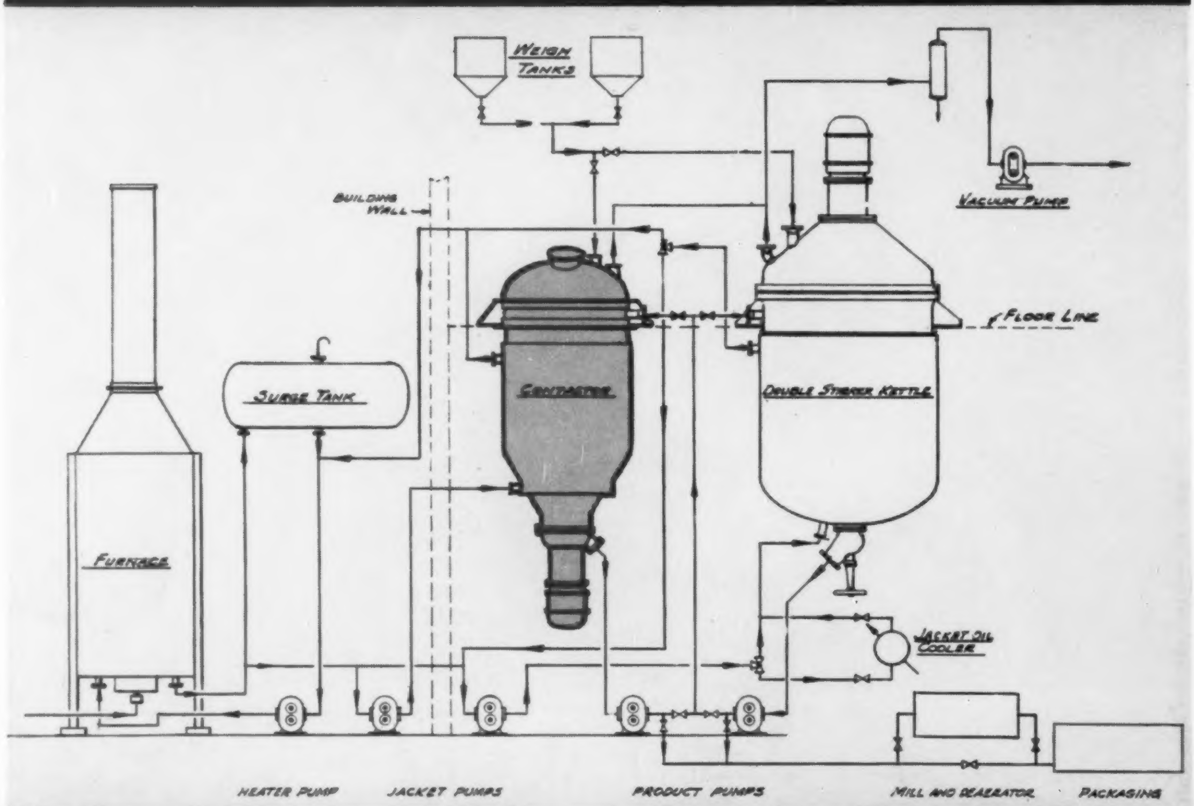
C. John Ebbrecht becomes representative for fatty acids in the New England and New York State area. He is a graduate of Calvin college, Grand Rapids, Mich.

Wallace E. Riffelmacher has been appointed sales representative for chemicals and plasticizers in the New York and New England area. A graduate of Colgate with an M.S. from Pennsylvania State, Mr. Riffelmacher is a member of the American Chemical society and formerly was with research administration of the U.S. Army, and also served as sales representative for the Du Pont company.

Raymond C. Wolfert will be sales representative for Harchem plasticizers in the Mid-West. Mr. Wolfert, a graduate of Muhlenberg college, came to Wallace & Tiernan from McKesson & Robbins, Inc.

The STRATCO contactor

Reg. U. S. Pat. Off.



and How It Simplifies Grease Making

The Stratco contactor is a highly efficient mixing device and when combined with the heating and cooling system shown above provides extremely close control of reaction temperature. With intimate contact between reactants and controlled temperature, very short batch time cycles are required.

Compared with other systems, Stratco grease plants produce more uniform greases with less soap and require less laboratory control.

A complete Stratco plant layout is illustrated above. Equipment is adaptable to modernization programs as well as new installations. Specific equipment recommendations made without obligation.

STRATFORD ENGINEERING Corporation

612 West 47th St. PETROLEUM REFINING ENGINEERS Kansas City 12, Mo.